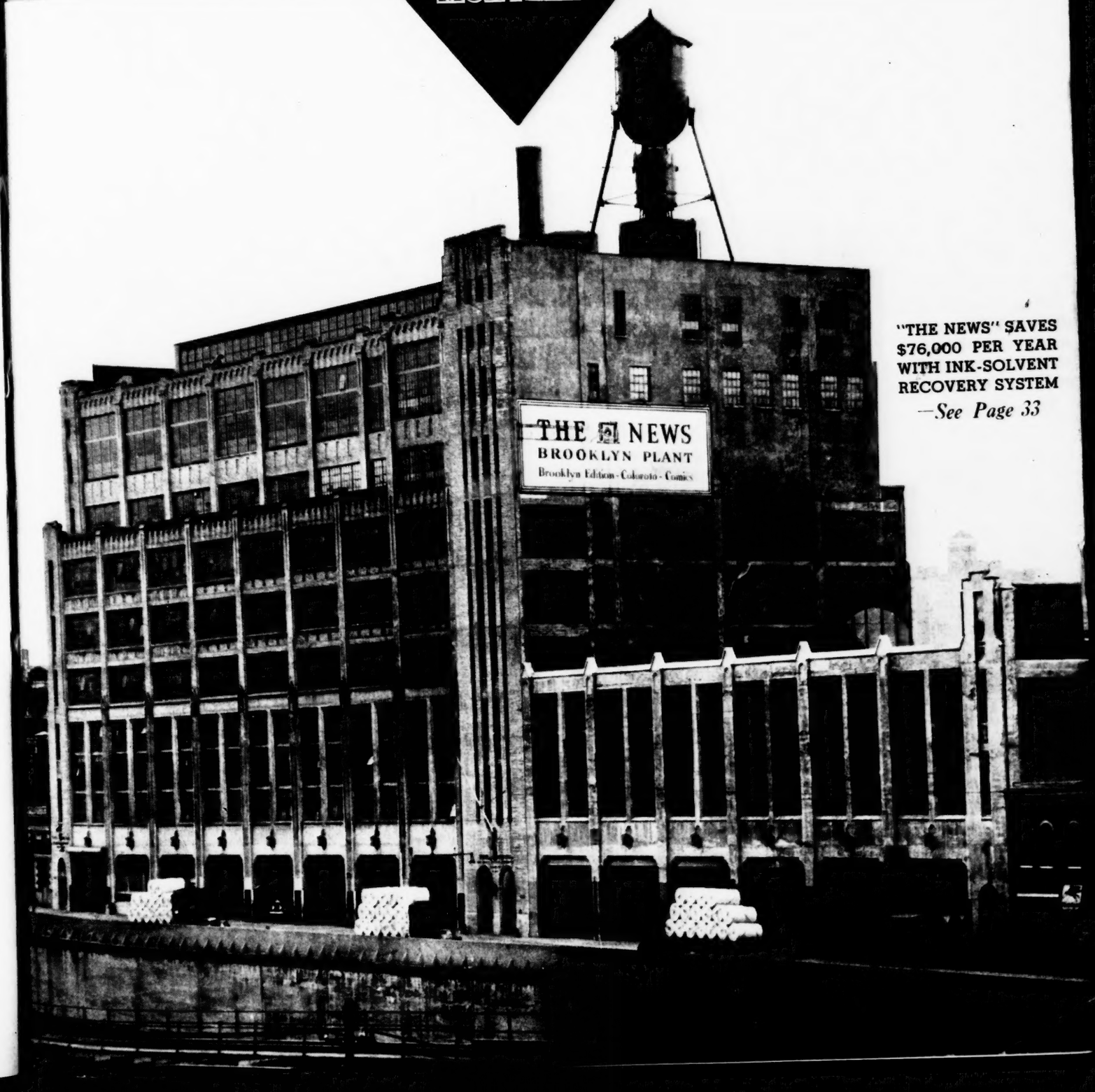
APR 19 1943

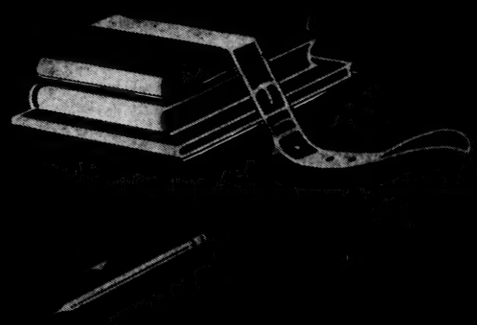
# HEATING AND VENTILATING

THE AIR CONDITIONING MONTHLY




"THE NEWS" SAVES $76,000 PER YEAR WITH INK-SOLVENT RECOVERY SYSTEM

—*See Page 33*



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# HEATING AND VENTILATING

*The Air Conditioning Monthly*


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**PUBLISHING INFORMATION**

HEATING & VENTILATING is published monthly by the Industrial Press at 148 Lafayette Street, New York, N. Y. Western office, 228 North La Salle Street, Chicago, Ill. Yearly subscription in the United States, Spain, South America, Mexico, and Canada, $2.00; in all other countries, $3.00. Single copies 30 cents.

**ADVERTISING REPRESENTATIVES**

Eastern Representative
ALGWYNNE COLLINS
148 Lafayette Street
New York, N. Y.

Western Representative
GEORGE G. TURNER
228 North La Salle Street
Chicago, Ill.



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## CONTENTS FOR APRIL, 1943


VOLUME 40 NUMBER 4



| | |
|---|---|
| New York Daily News | 33 |
| Operation of High Pressure Boilers | 37 |
| Converted Billing Machine for Lettering Drawings | 41 |
| Picture Paragraphs | 42 |
| How to Design Exhaust Hoods—Part 2 | 44 |
| Profits in Air—Mather Mine | 54 |
| Profits in Air—American Magnesium Corp. | 55 |
| Profits in Air—Ordnance Plant | 55 |
| Profits in Air—Westinghouse Lamp Division | 56 |
| Air Conditioning as Tomorrow's Method | 57 |
| Hot Water Tank Hook-Ups | 59 |
| Kitchen Air Conditioning of Drive-In Restaurant | 60 |
| Wartime Design Restrictions for Conservation | 62 |
| Non-Metallic Ducts—Are They Here to Stay? | 64 |
| Dry Ice Kills Coal Pile Fires | 67 |
| Washington News | 68 |
| Degree-Days for February, 1943 | 72 |
| Reference Data 243 and 244 | 74 |
| Reviews of Technical Publications | 76 |
| New Equipment | 78 |
| News of the Month | 80 |
| Personals and Personnel | 83 |
| With the Manufacturers | 85 |
| Industrial Degree Days for February | 87 |
| Coming Events | 87 |
| H&V's Photos | 87 |

THIS MONTH'S COVER

shows the Brooklyn plant of The News, New York's Picture Newspaper, in which the solvent recovery plant, described on page 33, is located.


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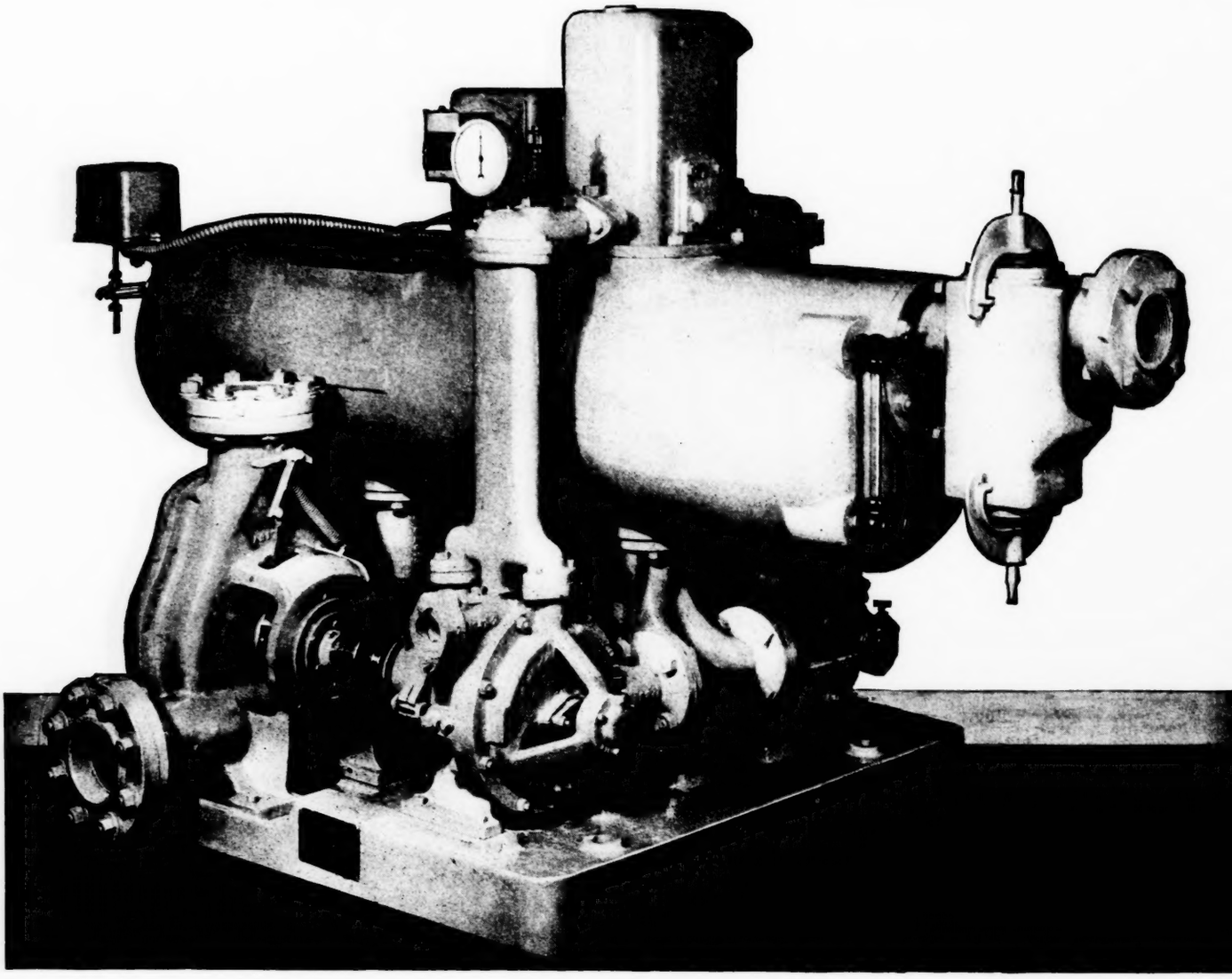
# Where building heat *MUST NOT FAIL*
# always specify the Nash Vapor Turbine



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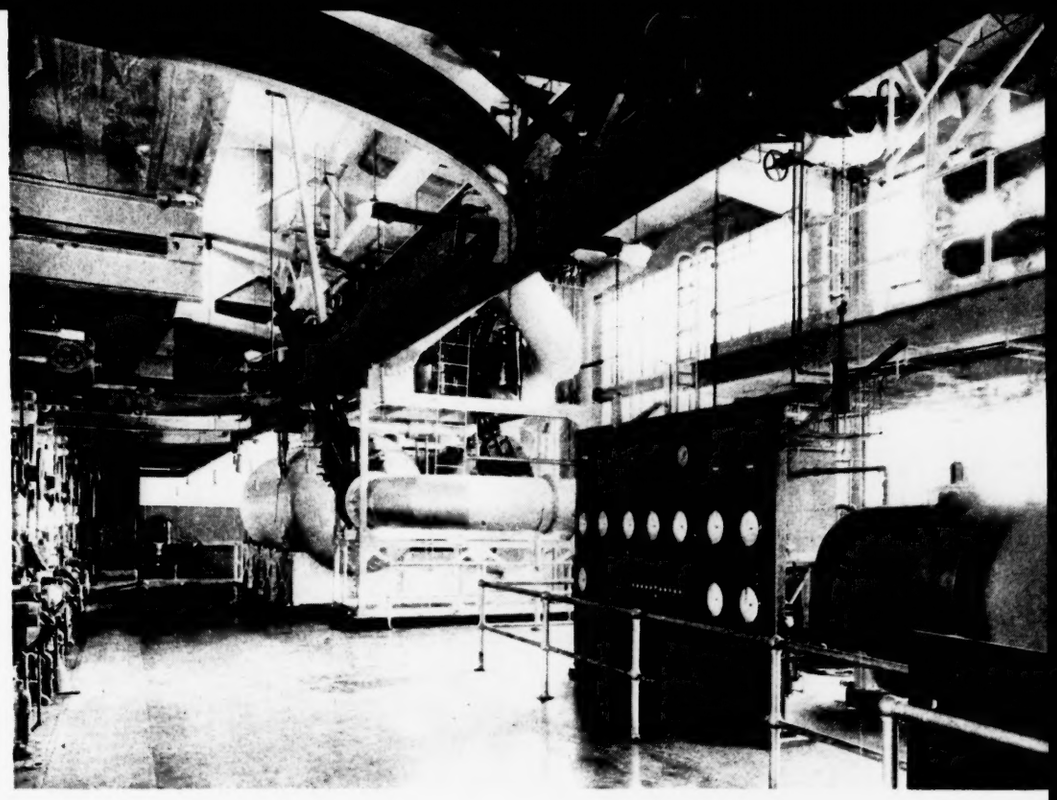


Fig. 1. Instrument panel and adsorbers in completely automatic solvent recovery plant in the Daily News rotogravure building in Brooklyn.

# NEW YORK DAILY NEWS

## *Rotogravure Printing Plant recovers over 300,000 gallons annually of ink-solvent—an impressive profits in air industrial application employing the activated carbon adsorption method. System described by T. F. J. Moffett.*

THE ventilation engineer often works hand in hand with the chemical engineer. Both are professionals in their own fields. The chemical engineer may write the prescription, as it were, and the ventilation or air conditioning engineer may design and provide part of the mechanical appurtenances. The project may be basically a matter of chemical engineering; but the ventilating hoods, ducts, damper controls, filters, roof exhausts, air washers, etc., may be familiar ventilating equipment. Jobs of this kind are returning great "profits in air" right now and face a huge backlog of demand in the post war period.

In general, this wide chemical engineering project embraces the safe and economical recovery of vaporized solvents in a big variety of industrial applications. Present war conditions, by the way, have created such a call for this kind of equipment that plants costing great sums would pay for themselves within a few months if it were possible to secure the materials and priorities. It is practicable, for instance, to recover millions of gallons of industrial alcohol at a cost of less than 5 cents per gallon.

The solvents are not all alcohols, by any means. They embrace also the groups known as esters, ethers, hydrocarbons, ketones, chlorinated compounds, and others. And the industries which make use of these low-boiling organic liquids comprise a long, imposing and growing list, such as rayon, rubber products, plastics, transparent wrappings, cellulose products, lacquer coatings, artificial leather, linoleum, smokeless powder, phenolic resins, rotogravure printing, spraying paints, dry cleaning, solvent extraction of oils and other products, and many more. It will be interesting to note one highly efficient application, the recovery of printing ink solvents in a great rotogravure plant.

In the Brooklyn rotogravure plant of the New York *Daily News*, one of the world's outstanding newspapers, there are produced each week about 4,000,000 copies of its distinctive Sunday pictorial supplement. Yet in that process of big-time printing

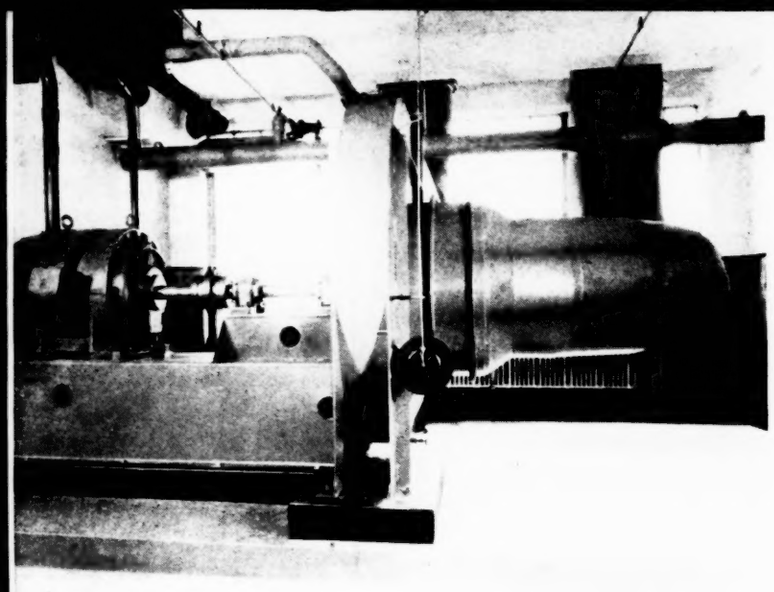


**Fig. 2. Motor driven blower drawing vapor-laden air from rotogravure presses and delivering it to solvent recovery units. The volume of air delivered by the blower is controlled by the speed of the motor and the vane mechanism in the inlet.**

the management of the *News* has achieved a notable contribution to the conservation of important materials at a time of war emergency shortages. Tons of solvents are recovered which would be otherwise wasted to the atmosphere.

The ink employed is made specially for rotogravure and comes as a thick paste. A *solvent* is used to thin it properly for the high-speed presses. When the presses are ready to go, they run 24 hours a day until the edition is completed. If none of the solvent could be recovered the year's requirements would amount to about 340,000 gallons. Almost the entire volume of added solvent is recovered, however, by a simple method which employs an activated carbon adsorbent to pick it up from the exhaust air. The adsorbed solvent is then steamed out of the activated carbon and made suitable for re-use.

Yet the part the ventilation engineer can play in planning some of the mechanical details for such installations, in cooperation with the chemical engineer, is a big one. On this point, Dr. Arthur B. Ray, of Carbide and Carbon Chemicals Corporation, New York, designers and suppliers of the recovery equipment at the *News* plant, relates that the efficiency of the vapor collection system installed over the presses will determine the overall efficiency of the vapor recovery equipment since "practically all the vapors passed to the recovery units are recovered."

Experience has demonstrated, Dr. Ray states, that with normal operation over 80% of the solvents used in high-speed rotogravure inks, including the solvents in the ink paste, are recovered by the Columbia activated carbon and that the operating expense depends on the cost of steam, water, and power. Under average conditions these costs should approximate 0.5 cent per lb of recovered solvent.

When the *News* rotogravure plant was first equipped with a solvent recovery installation, before wartime prices prevailed, the company reported a net saving of $18,960.00 for a representative quarter after deducting all operating expenses and amortization. The plant was operating at about half its rated capacity at the time, yet recovered 90,358 gallons of solvent. The plant capacity is 1,000 lb of solvent recovery per hour and 22,500 cfm of withdrawn air. Normally the plant operates at about half capacity for 80 to 120 hours per week. Its solvent recovery record has long since passed the million-gallon mark. It is the accepted rule and understanding as regards such investments that they pay themselves off in a relatively short period.

Some of the operating data on this recovery plant, of interest to planning engineers and based on reports from surveys, are as follows:

| | Per Pound of Recovered Solvent |
|---|---|
| Steam at 5 lb pressure | 3.5 to 4.3 lb |
| Water at 70F | Approx. 10 gal |
| E'ectric power | 0.13 to 0.17 Kwh |

This recovery plant making use of activated carbon was the first of its kind installed in a rotogravure plant in the United States. A considerable list of similar printing establishments will be calling for like equipment once the war is out of the way. Dr. Ray explains that a recovery plant using Columbia activated carbon seeks to reclaim efficiently, economically and safely any quantity of solvent vaporized under conditions which permit the vapor-laden air to be collected from the manufacturing process, even though the vapor concentration is extremely low and water vapor is also present. There is a cue in this for the ventilation engineer. It is a mechanical project to gather the vapor-laden air through hoods, ducts and exhaust fans and transport it to the activated carbon adsorbers which efficiently do their work. The activated carbon method is stated to be effective for practically any solvent or combination of low-boiling solvents vaporized in manufacturing processes.

The recovery unit in the rotogravure plant mentioned is the type most likely to be desired by the printing industry where both water soluble and insoluble solvents may be employed, Dr. Ray explains. The inks used in modern high-speed rotogravure work contain a mixture of valuble volatile solvents. Some of those commonly employed are ethyl acetate, isopropyl acetate, acetone, ethanol, benzene, naphtha, and other hydrocarbons.

In the rotogravure printing process, paper is

**Fig. 3. Duct system carrying vapor-laden air from rotogravure presses to solvent recovery plant. Small building houses automatic safety valve which vents directly to the atmosphere in an emergency.**

passed at the rate of 1,000 to 1,500 fpm. It goes through driers, where a large percentage of the solvent is vaporized by air brought in turbulent contact with the surfaces of the paper, air thrown in by a blower at each unit. The vapor-laden air passes through branch ducts into a main duct having a large exhaust blower at its terminal. Some of this duct system is pictured in Fig. 3, as installed in the *Daily News* plant. There are 21 branch ducts altogether, running to 21 units. At its large end the main duct is 36 in. in diameter.

The motor-driven exhaust blower and its housing appear in Fig. 2, also the manner of connecting the main duct. The motor is 125 hp, two-speed. The discharge from the main blower delivers the vapor-laden air drawn from the rotogravure presses to the solvent recovery adsorption units. A large filter removes all dust and lint from the air before it reaches the recovery equipment.

The volume of air delivered by the main blower is determined automatically by the number and speed of the presses operating and by the speed of the motor and the special vane mechanism in the inlet to the blower. The air is passed to the adsorbers shown in Fig. 1, where it filters through a bed of Columbia activated carbon, which retains the solvent vapor. The solvent-stripped air is then discharged to the atmosphere. The operation of the adsorbers is automatically controlled through instruments appearing on the panel in Fig. 1. Some of these instruments control also the distillation of the solvents steamed out of the carbon bed.

The flow-chart diagram of Fig. 4 shows the operation steps of the simplest type of a solvent recovery plant intended for continuous service. The filtered vapor-laden air (cooled if required, using water) is drawn under automatically controlled conditions from the printing plant and passed to the bed of activated carbon in one of the adsorbers. The passage of the vapor-laden air through the adsorber is continued until the activated carbon bed has adsorbed the intended quantity of solvent.

If the vapor is passed to the carbon bed at a constant rate, the proper charge is obtained by keeping the adsorber in service for a definite period. But if the vapor-laden air arrives at a widely varying rate, as is most often the case, an especially sensitive vapor detector in the air stream exhausted from a portion of the carbon bed indicates when the bed has been properly charged. The outgoing air is then diverted manually or automatically to the other adsorber.

Next the adsorbed solvent is driven out of the charged carbon bed by introducing low-pressure steam at a controlled rate below the carbon bed. The steaming time varies from 15 to 60 minutes, and then the adsorber is ready to be placed in service again. The steam passing through the charged carbon bed causes the release of the adsorbed solvent, and then the steam-solvent vapor mixture passes out of the adsorber and into the condenser.

If the solvent is not appreciably soluble in water, it is separated by decantation. Sometimes the solvent is a mixture consisting of both water-soluble and water-insoluble solvents and hence requires both decantation and special distillation. At any rate, the recovered solvents are properly distilled so that they may be freely re-used. At the *News* plant the annual recovery of such solvents now runs to 338,000 gallons.

Since the printing presses are operated at various speeds and the amount of ink applied varies also, the recovery installations are designed to keep automatically in step with the printing load. When one adsorber becomes fully charged it is automatically cut out of service and the other adsorber automatically cut in. Each adsorber is, therefore, normally steamed when it is fully charged from the vapor-laden air, with the result that the required amount of steam and water remains constant per pound of recovered solvent even though the printing operations vary considerably as to load conditions. The special automatic features of the recovery system employing Columbia activated carbon are extremely important in rotogravure installations so as to assure safe operation without interruptions.

The recovered solvents are also automatically dehydrated and made ready for re-use. At the same time, the recovery equipment generally installed is sufficiently flexible to handle any of the solvent mixtures which may be used in different high-speed rotogravure inks. It is to be emphasized that the efficiency of the vapor collection system installed with the presses will determine the overall vapor recovery

results, remembering that practically all of the vapors passed to the adsorbers are recovered.

As regards the *News* plant, it is stated that power consumption is higher than in some other solvent recovery plants because the solvent concentration is unusually low—about 0.4 lb of solvent per 1000 cu ft of air. Yet there are already certain improvements in plant design which permit lower power consumption when low solvent concentrations must be handled.

It should be mentioned that the drawing off of the vapor-laden air in this printing plant is also a form of comfort ventilation for the workers. There is no special fresh-air intake. The plant depends on ordinary window and doorway infiltration during the heating season. One considerable section of the rotogravure building has full all-year air conditioning, however. It provides stabilized atmosphere conditions in a department handling preliminary process work in preparation for the actual printing.

Dr. Ray relates that the most generally used method of recovering all types of solvents at the present time is by activated carbon adsorption. "This solid adsorbent, when of the proper type, is specially made for efficient and low cost recovery of solvent vapors under widely varying conditions. The activated carbon adsorbs substantially all the vapor from the air regardless of variation in concentration, temperature, and humidity conditions. Because the adsorbed solvent has practically no vapor pressure at normal temperatures, the carbon system is particularly adapted for the efficient recovery of solvents present in air in low concentration." He adds that this means that recovery systems employing Columbia activated carbon can always be designed for operation without hazard because the vapor concentrations are below the flammable range.

The Columbia activated carbons used for solvent recovery are manufactured from cocoanut shells and are in the form of hard, strong granulated pellets, usually ranging in diameter from ¼-in. to 1/16-in. and weighing from 25 to 34 lb per cu ft. These carbons intended for solvent recovery have special attributes, such as highest effective adsorptive capacity under the conditions of use, easy release of adsorptive vapors, maximum selective adsorption of organic vapors in preference to water vapor, optimum size and shape of particles with an eye to low resistance to air passage, and high resistance to breakage and to deterioration during use.

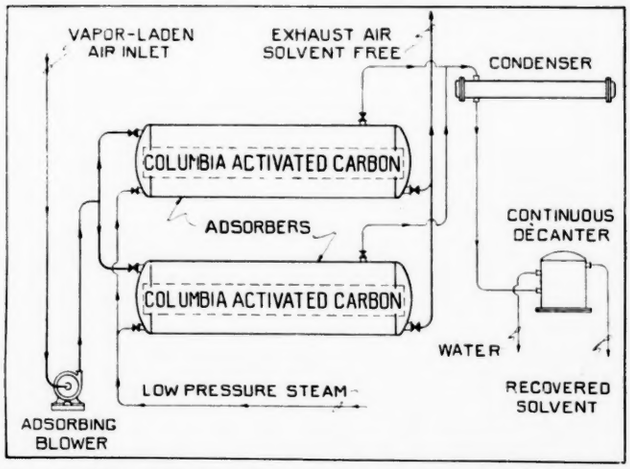



**Fig. 4. Flow diagram of recovery plant operated without cooling cycle.**

That side of the story embraces chemical engineering. The ventilation engineer and contractor still have a major part to play in designing and supplying vapor collecting equipment required in the many industrial applications which will employ activated carbon recovery systems. A partial list of these industries includes: Rayon, other synthetic fabrics, making and applying plastics, making and applying rubber products, moisture-proofing of transparent wrappings, lacquer-coated or impregnated fabrics, artificial leather, book bindings, the manufacture as well as the use of printing inks, various "glassine" papers, awnings, degreasing of metals, collecting solvents from fermentation gases, spraying automobile bodies and similar coatings, recovery of gasoline and other hydrocarbons from natural gas, and an almost endless number of other uses.

**Photographs in this article appear through the courtesy of Carbide and Carbon Chemicals Corporation, designers and suppliers of the recovery equipment here described.**

The ventilation system was installed by B. Offen & Co., Chicago, Ill. Automatic instruments were supplied by The Bristol Co.

## Air Conditioning for a Chinchilla Cage

Chinchillas thrive in a cool climate; their natural habitat is some 13,000 feet above sea level in the Andes. When they are brought down to sea level, however, man must provide the cool, dry mountain air artificially.

In a recent exhibition to show the strides made in developing its national fur industry, the Ministry of Agriculture of the Argentine Republic brought a pair of chinchillas down from the government nursery located at Abra Pampa. To keep the valuable little animals alive during the 20 days of the exhibit, the authorities built a cage for them atop a General Electric room air conditioner. To prevent air currents which might harm the animals, the conditioned air was discharged at the front and conducted between double glass to the top of the cage, where it was distributed uniformly throughout the cage by openings in the double ceiling. The conditions, roughly equivalent to the climate then prevailing in their natural surroundings, were from 59F to 62.6F, with a relative humidity of 60%. These conditions were held by the room air conditioner.

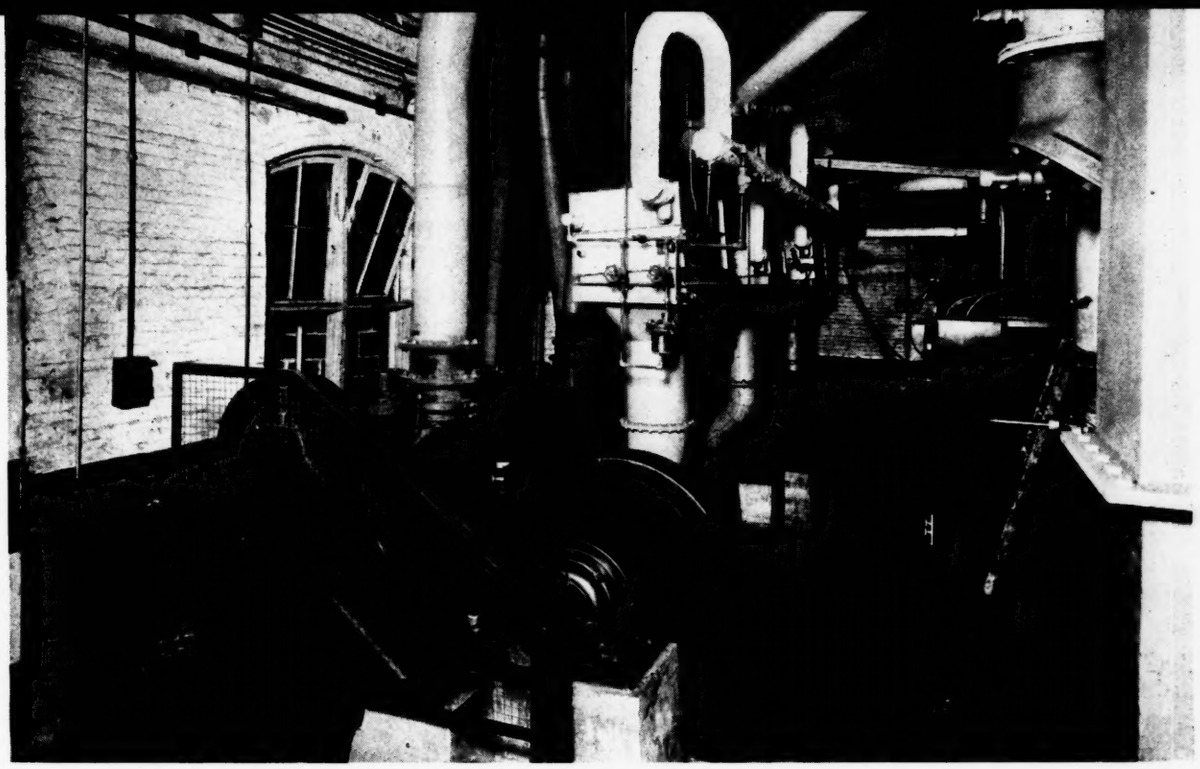


*Fig. 1. Coal pulverizers for high pressure industrial boilers.*

# Operation of High Pressure Boilers

**By FRED D. MOSHER**

THE introduction of high pressure steam generating units for general use in industrial plants accelerated the advance of improved operating techniques to keep pace with advances in design. The severe load conditions being imposed on industrial boilers, the need to conserve fuel, and the necessity for avoiding forced outages make it imperative that present practices be refined and observed religiously.

## Need for Planning

The operation of high pressure boilers, much of the output of which is used for heating purposes and process work, must be planned along definite lines: (a) operation must obtain from the units the mechanical performance expected; (b) utilization of fuel must be efficient under all load conditions; (c) outages should be scheduled and not forced on the plant.

The guaranteed efficiencies of modern steam generators are for the most part much higher than those obtained from older designs. Efficiencies from 80 to more than 90 per cent are being produced and methods must be appropriate for such high grade performance. The elements which the operator is concerned with are equipment operation, fuel burning, and maintenance of the steam generating unit. Close control of the elements is essential. The over-all plant efficiency is obviously affected by distribution of generated steam for heating, processing, and power generation; benefits from sound boiler operating practice materially affect the over-all results.

## Feedwater Conditioning

The rapid advances of boiler pressures to the higher brackets have aggravated the problems encountered in feedwater conditioning. There have always been feedwater problems in steam plants, but proper recognition was not given to this phase of operation until recent years. Unfortunately, the ravages of agents common to most waters are not always apparent, and the unseen is often accompanied by indifference until troubles develop. On the credit side is the fact that feedwater quacks have almost entirely disappeared from boiler rooms, and competent technicians have raised the science to the position it deserves.

The prime requirement for good feedwater conditions in a boiler is that surfaces be clean to start with. There is a too common misunderstanding in operating circles that *compounds* will remove scale; this idea is wrong. The term *compound* is a bad choice since it connotes the thought that boiler water troubles can be corrected with some kind of concoction of the patent medicine variety. Heavy deposits in boiler tubes can only be removed by mechanical cleaning involving considerable physical effort, loss of boiler service, and the expenditure of money; a more recent method is the use of acids, properly inhibited, for dissolving and removing of adhering deposits. Once surfaces are clean, accepted methods of scale prevention may be instituted with successful results.

## Scale Prevention

The maintenance of clean steam side surfaces requires that the scale-forming agents such as silica, calcium and magnesium salts, be prevented from depositing. At high pressures the tendency for these deposits to give trouble is very great. The three methods of control are (1) regular blowdown, (2) removal of the undesirable material before the water

is fed to the boiler, and (3) subsequent treatment of the boiler water to prevent final traces from depositing. External treatment is accomplished through the use of lime and soda processes of various designs which may be determined by the nature of the plant in question. The boiler water is further conditioned by subsequent treatment with soda ash, phosphates, and tannins, or other agents which will maintain alkalinity, reduce hardness and perform dispersive functions. Recommendations for water conditioning are the field of the feedwater chemist, but controls and regular checks are part of boiler operation.

The design of high pressure equipment includes devices to prevent the carrying of solid matter into steam lines. Neglect of feedwater conditioning may counteract the desirable effects of washing and purifying apparatus. Regardless of the type of external treatment used, a small amount of scale-forming material will pass to the boiler since almost all water impurities will dissolve more or less in water. Once in the boiler such substances will tend to promote carryover at high ratings and pressures.

### Corrosion

The corrosion of boiler plate costs millions of dollars annually, and along with bad feedwater it is responsible for most boiler accidents, according to one of the large boiler insurance companies. Little is known about the phenomenon of metal corrosion but its effects are known to all. The conditions which apparently are necessary for the action are the presence of oxygen in the boiler water or acidity or both. The best known preventives are complete deaeration of dissolved gases such as oxygen and carbon dioxide and the maintenance of the feedwater in an alkaline state. The alkalinity of water is maintained by providing an excess of sodium carbonate and the degree of alkalinity is determined by the pH value. The common test for dissolved oxygen is the Winkler test, the accuracy of which is adequate for boiler plant operation. The checking of boiler feedwater by plant personnel varies from simple color comparisons for pH readings to conductivity tests for total solids. A minimum of checks which should be made and which are easily done are (1) dissolved solids, (2) pH value, (3) hardness, and (4) dissolved oxygen. When such checks are made regularly and records kept, a material contribution is being made to the solving of any feedwater problems that may arise.

### Caustic Embrittlement

The problem of caustic embrittlement, a term applied to a condition often found in parts of boilers such as riveted seams where highly stressed metal is in contact with highly concentrated water of a caustic nature, has never been entirely settled although various theories have been offered to explain its causes. The symptoms are generally understood, and its disastrous effects are on record. In order to prevent the possibility of this condition developing it has been recommended that the boiler water be treated with sulphates which will inhibit the action of the caustic soda. The A.S.M.E. Ratio for high pressure boilers requires that sodium sulphate be present in a ratio of three parts to one of caustic soda.

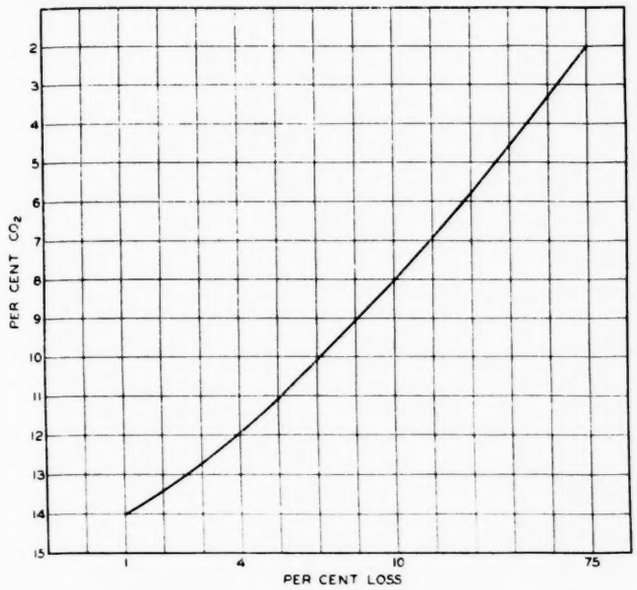
### Scheduling Outages

For obvious reasons boilers will not give service indefinitely without requiring minor repairs, cleaning, and the correction of troubles common to any equipment subjected to daily wear and tear. The purpose of scheduling boiler outage is to keep availability high; continuing the unit in service until the outage is forced will have the opposite effect on availability. Other reasons for scheduling outages now have considerable importance. Chief among these are the necessity for fuel conservation and the maintaining of units in condition to carry more than normal loads.

The time at which a boiler must be taken off the line for cleaning and inspection will depend on the kind of service, load conditions, and operating methods. For example, a boiler used solely for heating purposes would be properly cleaned and inspected at the end of the heating season, while others used to supply process steam or power in addition to heating would have its outage influenced somewhat by plant production. The type of fuel being used, life of refractory, condition of fuel burning equipment, and condition of other units are the main considerations along with the general performance of the unit in question.

### Instruments and Their Use

A minimum of temperature reading instruments, gas analyzing apparatus, and recorders will greatly assist boiler operation and will help in scheduling outages. For any given steam generator steam will be produced at a minimum cost when fuel combustion is properly controlled so that temperatures of steam, exit gases, combustion air, and feedwater are normal for the load being carried. Any great variation from these normal conditions is a call for investigation. Gradually increasing gas temperatures are a warning that heating surfaces are being fouled with ash, slag, or soot deposits. Abnormally low $CO_2$ is often an indication of dilution of gases by air leakage through the setting. Damaged refractory in walls and baffles will increase fuel consumption and raise stack temperatures. An increase in the loss of combustible to the ashpit accompanied by furnace slagging may indicate temperatures higher than required for efficient fuel burning. The standard for a boiler should be established with equipment in good working condition, with the setting tight, and surfaces clean. Although such a standard cannot be maintained it must serve as a yardstick for good operating procedure. Whenever conditions permit, the variation between actual performance and the expected should not be allowed to become too great. Fig. 1 illustrates how such changes occur pro-



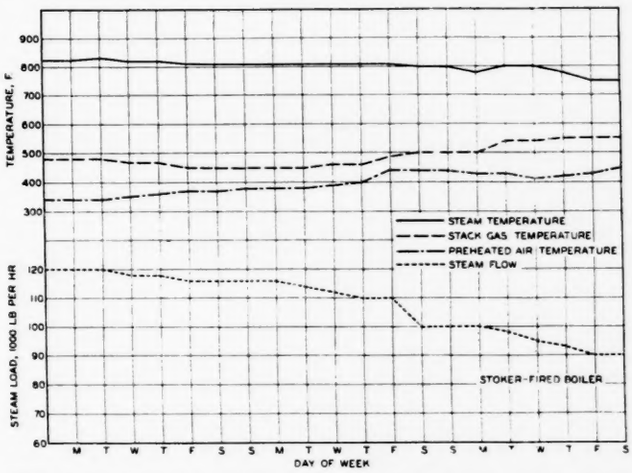


TEMPERATURE, F
STEAM LOAD, 1000 LB PER HR
DAY OF WEEK
STEAM TEMPERATURE
STACK GAS TEMPERATURE
PREHEATED AIR TEMPERATURE
STEAM FLOW
STOKER-FIRED BOILER
M T W T F S S M T W T F S S M T W T F S

*Fig. 2. (Left) A typical excess air-heat loss curve showing how losses increase as abnormal amounts of excess air lower the $CO_2$ and increase heat loss to the stack.*

*Fig. 3. (Above) Actual case history of a high pressure boiler which, due to lack of proper cleaning, had to be taken off the line. Of particular interest is the rapid increase in stack gas temperature, which in turn raised the temperature of the preheated air to the point where the stoker tuyeres burned. The load kept dropping gradually, and the steam temperature fell off considerably.*

gressively, and why a continual following of the in-instrument recordings will prove a valuable guide in maintaining good performance.

The essentials for properly burning any fuel are (1) that the fuel be intimately mixed with the combustion air, (2) that the furnace temperature be sufficient to support burning, and (3) that the air be supplied in proportion to the fuel burned. The satisfying of these requirements is dependent upon the equipment which supplies the fuel and air and the way in which it is operated and controlled.

## Powdered Coal

Units using pulverized coal must be so handled that a number of conditions are met simultaneously. Fineness of coal should be maintained so that the maximum fuel surface is exposed for mixing. Fineness should be checked periodically because boiler performance will be seriously affected when this factor is neglected. Constant fineness of a high degree promotes good combustion, prevents excess carbon loss, and permits good furnace distribution. Considerable attention must be given to coal dryness to assist grinding and distribution through burners; adequate control of quantity and temperature of primary air must be available to the operator.

Much misunderstanding is abroad regarding the hazards of handling and burning pulverized coal. Powdered coal can be burned without danger of furnace explosions if a few cardinal rules are understood: (a) sufficient load must be carried to keep a stable fire burning: (b) air supply must be adequate for the amount of fuel being furnished, without velocity being high enough to blow out flame; (c) lighting torches should have good flame volume so that lighting will not be delayed when fires are started; and (d) blowers should be used to purge furnace and setting of all unburned fuel before fires are lighted, and this should be done following flame failures.

Plants using pulverized fuel should maintain fineness standards. Authorities on fuel burning insist that the right fineness is one of the important essentials to successful pulverized-coal-burning. Frequent checks ought to be made and mills kept in condition to produce the required fineness. Good fineness will promote good mixing and burning, and keep combustible losses to the ash at a low figure.

## Stokers

The abuses to which stokers often are subjected usually include poor maintenance, overloading, and use of the wrong fuels. When overloaded or supplied with fuels other than those for which they were designed, stokers often are damaged by burning as a result of high temperatures. As the fuel situation becomes more critical the tendency to switch or mix coals will get more pronounced. Coals can be mixed and successful operations with 50% mixtures of bituminous and anthracite have been known, but such practice is not too highly recommended. Traveling-grate stokers must have the fuel supplied evenly and unless the mixing is done thoroughly, there will be an increase in the possibilities of segregation, and this should be avoided. Slack coals, if the slack tends to be excessive, will be improved for burning by wetting in conveyors. Sufficient ash should be maintained on the grates to prevent burning of the stoker.

High capacity underfeed stokers will handle most low-grade fuels over wide ranges of load, but with improper operation the maintenance may be high. Heavy fuel beds are carried with such stokers, and if the air supply is inadequate much loss of fuel to the ashpit will result. Too frequent dumping of the grates, fuel burning on dump grates, and forcing should be avoided. Proper air control will prevent the formation of heavy clinkers at the rear of the stoker—a source of much fuel waste.

### Oil-Fired Equipment

In spite of the curtailment on fuel oil a large number of industrial plants will continue to burn oil for heating and other purposes. The correct handling of the oil heating, pumping, and burning equipment will enhance the possibilities of reducing consumption. The type of fuel now being supplied for industrial boilers is not improving in burning qualities, and is not likely to get better in the future. In handling low grade oil it is very important that the oil temperature be constant and that the oil heaters be clean at all times. It should be definitely established what the maximum temperature must be; knowing the minimum temperature is just as important. Too high temperature will tend to deposit carbonic matter in the heaters and this will make pumping more difficult, increase maintenance, and require more frequent outages for the heaters. The essentials for proper burning of oil are that the temperature be sufficient to permit vaporization of the oil so that intimate mixture with the air can be obtained; the pressure on the burners must be high enough to promote a spraying condition; the pressure must be constant to maintain the fire at the correct intensity. Too hot oil, in addition to giving heater troubles, will result in a pulsating flow which is not conducive to good burning or control. Oil that is too cold will give incorrect atomization and poor mixture; under such conditions there will be a smoky fire with heavy soot emission and a consequent loss of fuel.

### Combustion

Good combustion in a furnace requires that the fuel be supplied in such a way that the furnace volume will be efficiently used. For example, a furnace used for burning pulverized coal must have ample combustion space to provide for effective mixing of fuel and air and for burning the fuel to completion, and of such design that ashes can be removed adequately. The operator should be concerned with maintaining burner capacity so that each unit in the burning equipment does its share. Temperature must be maintained to permit slag tapping, and this means that close air control should be maintained so that too much excess will not result in clinkering instead of fusing. A balance must be maintained on the air supply so that it is not reduced to the point where carbon loss to the ash is a resulting disadvantage.

The same problem regarding air supply exists with stoker-fired units. Lack of air tends to raise furnace temperatures to the point where the ash fuses and remains in the molten condition. With this condition existing in the fuel bed green fuel will adhere to the molten particles of ash to be later carried to the ashpit in the form of clinkers. High furnace temperatures bring about accumulative effects through the furnace, convection surfaces, and boiler passes. Brickwork will suffer from the deposit of large amounts of molten slag and from its subsequent removal as clinkers. Stoker parts such as tuyeres and grates always burn when the furnace temperature becomes excessively high for extended periods. With high temperature prevailing in the furnace the heat-absorbing surfaces become insulated with slag, and molten ash is carried to the setting to deposit on convection and superheater surfaces, further reducing the capacity of the unit and lowering efficiency.

Even when fans are adequate for the boiler in question, there may be a lack of air due to any of several causes: (1) dirty passes and surfaces, which cause high stack temperature with consequent high preheated combustion air temperature with its adverse effect on stoker operation; (2) increased resistance of the boiler due to the fouling of the surfaces, which reduces the fan output and makes an adequate air supply impossible; (3) an increase in load, making the fans inadequate for the amount of fuel being burned; (4) excessive air leakage through the setting, tending to overload the fans.

The importance of keeping surfaces clean cannot be stressed too much. This involves regular operation of soot blowers, and when loads are increased supplementary means of cleaning, such as air or steam hand lances, may have to be provided.

### Boiler Losses

Boiler losses which increase fuel consumption, reduce boiler capacity, and result in dollar waste are present in varying degrees in all plants, and are due to the following courses:

1. Excess air. (See Fig. 2.) Careless handling of the air supply results in considerable heat being carried away to the atmosphere. Normally, it is desirable to operate without smoke, but when this objective is over-stressed tons of fuel are wasted in heating the atmosphere.
2. Too little air. In attempts to keep $CO_2$ high, zealous operators often will overlook other pertinent factors. If high $CO_2$ is accompanied by CO nothing is being gained since the presence of CO is a good indication that combustible loss to the ash is being increased. In seeking to establish a desirable $CO_2$ for a boiler some balance must be obtained which will prevent the formation of CO and where the loss of unburned fuel will not outweigh other advantages. Among the items to be considered are steam temperature and also the temperature of the preheated air, the latter being dependent on the quantity and temperature of the stack gases.
3. Air leaks in the boiler setting. The air leakage has a cooling effect on the boiler but will increase the stack heat loss by acting as a conveyor of useful heat away from the boiler. The resistance of the unit is increased and the draft is reduced, which immediately calls for more work from the combustion air fans. Gas analyses are quite misleading when the air leakage is high because of dilution. It is axiomatic that an essential requirement for efficient boiler operation is a tight setting.
4. Radiation. Modern steam generating units

usually lose less than one per cent in this way, yet in older installations, and in those where the insulation has been neglected, much greater losses are common. Frequent checks should be made with thermometers or thermocouples to determine the amount of heat being wasted from this source.

5. Dirty heat transfer surface. Regular cleaning of the heating surfaces should be a part of operation. It must begin when the surfaces are clean since the job becomes more difficult and often impossible once soot and ash have become firmly deposited. Periodic checks on the temperature of the outgoing gases are recommended as a means of determining the extent of fouling with deposits. Keeping internal surfaces clean resolves itself into correct diagnosing of feedwater conditions and treating for desired results.
6. Failure to make proper use of instruments such as temperature recorders, thermometers, flow meters, and draft gages. They must be properly maintained, and should be located where they can be seen easily, and used always to the best advantage. Instruments themselves will not correct losses, but their use will serve to reveal many that are not obvious.

# Converted Billing Machine for Lettering Drawings

Lettering on engineering drawings is essential to the finished job. It will enhance or detract from the appearance of the work depending on the proficiency with which it is executed.

Fast, symmetrical free-hand lettering, the good draftsman's stock-in-trade, is the result of many years of practice. Such draftsmen are hard to find today.

Another method is the use of the typewriter. A stenographer or typist may, from dictation or the draftsman's longhand notes, do complete or partial lettering jobs on drawings. However, a machine which will accommodate large drawings is not only usually high in cost but the visible working area is very limited. In large engineering organizations the acquisition of this type of equipment may be justified by the volume of lettering performed, but in smaller organizations of eight or ten draftsmen the cost might prohibit its use.

An economical means of obtaining a machine with the desired characteristics can be had by modifying an Underwood Elliott Fisher billing machine, as shown in Fig. 1. The platen is cut into three sections which are then re-supported from a sub-base by means of spacer feet. Cutting the platen into three sections forms two slots which allow the drawing to pass through and be rolled in the space between the platen and the sub-base, as shown in Fig. 1. This arrangement will take any size drawing, both as to length and width, as shown in Fig. 2, and provides a composing area, visible in Fig. 2, of 18 in. vertically by 16 in. horizontally for one setting. The tracing may be slid lengthwise or rolled vertically for other settings.

Care should be taken in the choice of a ribbon. The ribbon should not require carbon backing to obtain an opaque image. It should be quick-drying to prevent smudging, and be free from bleeding on the surface of the drawing, and leave no ghost marks after erasures are made.

It will be found that complete typing jobs on drawings are uneconomical from a time-saving viewpoint, and that it is more efficient to confine the machine work to titles, voluminous notes, bills of material, and the like, leaving minor notes and dimensions to be lettered by the draftsman. — *F. P. Kuhl, Chief Draftsman, Consolidated Edison Co. of New York, Inc.*

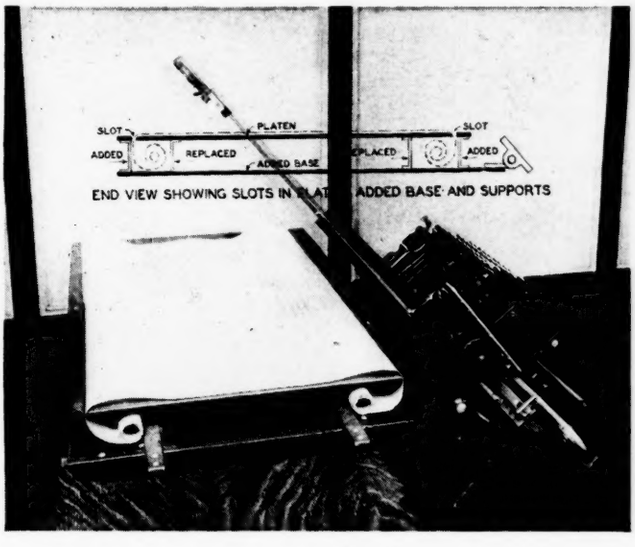



*Fig. 1.*

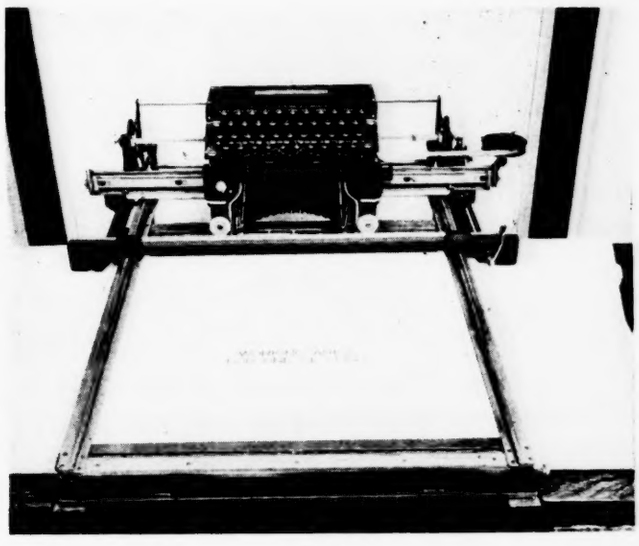
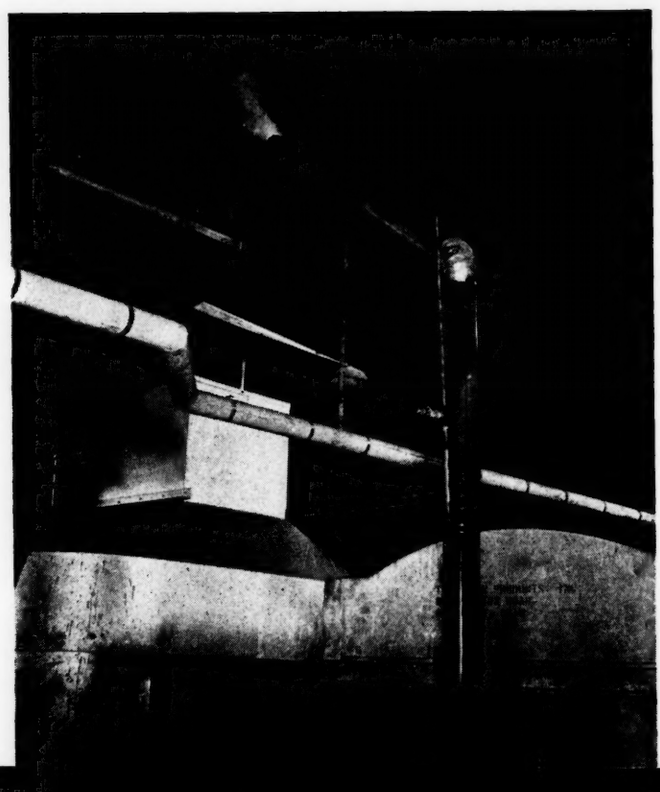


*Fig. 2*

# PICTURE PARAGRAPHS

**FIBERGLAS INSULATION** in the walls and flooring of this new type portable shelter for use by Army Air Corps personnel in Arctic climates saved more than 20,000 lb in the weight of the fuel that must be transported to maintain in each shelter, throughout the heating season, a temperature in which men can live comfortably. The shelters can be transported by air

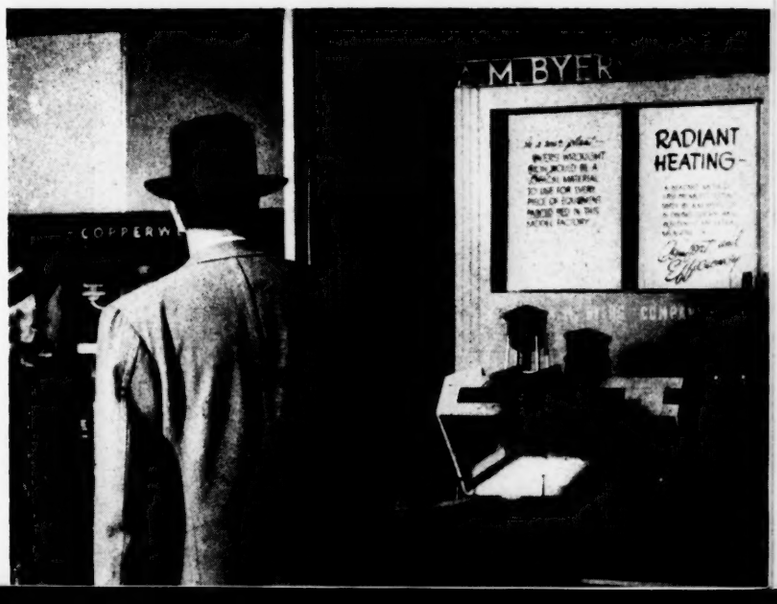
**OIL PIPELINE PUMP** for War Emergency Pipeline, Inc., will aid in averting oil shortage next winter. The centrifugal pump shown here, built by Ingersoll-Rand Co., will operate against a head of 707 ft. Three of these operate in series to attain the high head of 770 lb per sq in. required.



**AIR JET STARTS DRAFT.** A 60 lb compressed air jet in this furnace flue carries off fumes until the normal draft is established when the flue warms up. The air line has an elbow on the end inside the flue to direct the air upward. Photo by Compressed Air Institute.

**SIX GIRL WELDERS** are building war materials in the plant of Acme Industries, Inc., Jackson, Mich., heat exchange manufacturers. Twenty-year old Dorothy Hunt, shown at left, is one of those; she is a graduate of Laingsburg, Michigan, High School, completed an arc-welding course at Lansing, and started with Acme in January.

**STERILAMP KEEPS PEPSI-COLA PURE.** (Left) Under the glow of their protective radiation, lines of Pepsi-Cola bottles move, continually bathed and protected by ultraviolet rays until the filling and capping operation is finished. (Right) Atop the world's largest syrup tank at the Pepsi-Cola plant engineers examine one of the Westinghouse germ killing lamps. Containing inert gases and mercury vapor which produce beneficial ultraviolet light, the lamps destroy or inactivate up to 98% of air-borne bacteria. Fifty Sterilamps are placed 10 ft apart on this tank and if one fails, an automatic light flashes in the plant.




**RADIANT HEAT EXHIBIT** of the A. M. Byers Co., in Kaufmann's, Pittsburgh's leading department store, where industrial wares of heavy industry were recently displayed. Floor of model factory is lined with lucite tubes to illustrate pipe coils.

# How to Design Exhaust Hoods

By J. M. DALLA VALLE
Engineer and Consultant, Kruse Engineering Co., Newark, N. J.

## PART 2—VELOCITY CHARACTERISTICS OF COMMON TYPES OF UNOBSTRUCTED OPENINGS EXPERIMENTALLY DETERMINED

CONTOURS, except for simple openings reducible to two dimensions as discussed in Part 1, are impossible to determine by mathematical procedures. Even in the cases mentioned, the labor involved in plotting velocity contours and stream lines is tedious and time-consuming. For these reasons, it is practical to outline an experimental approach to the determination of hood velocity characteristics. The value of this procedure is further enhanced when it is considered that the characteristics of large hoods may easily be determined from scale models, as previously already pointed out. The method obviously depends upon a device suitable for measuring point velocities.

### Measurement of Point Velocities

Low air velocities cannot be determined except by sensitive instruments. One of the difficulties of the ordinary pitot is the fact that the total and static pressures are not measured at identical points. Consequently, in regions where the air movement changes rapidly, as at an opening under suction, the ordinary pitot cannot be used. For such conditions, a tube of the type shown in Fig. 6 may be used. This tube consists of a thin brass cylinder approximately ⅛ in. in diameter, with two independent compartments closed at one end. Two small holes 0.02 in. in diameter are drilled at its midsection and a pointer is fastened near the open end in the direction of the opening. To measure duct velocities, the tube is inserted diametrically through the duct, with the pointer directed along the axis. The readings so taken are a measure of the velocity head. They are much larger than those obtained for an ordinary pitot, ranging from about 1.6 to 1.75 times greater, depending upon the velocity measured.

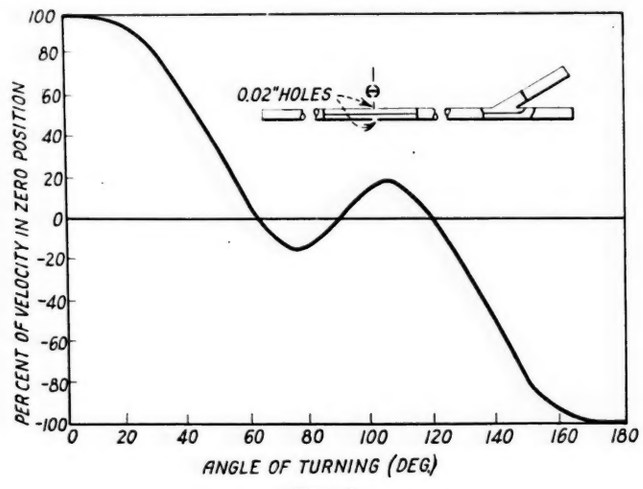


Fig. 6

A special mounting is required for measuring velocities by the special tube described. The tube is turned at the desired velocity point until a maximum reading is obtained on a manometer. The tube is very sensitive to the direction of flow and can be used as an indicator within ± 15° of arc as may be seen from the characteristic shown in Fig. 6. Because of the comparative smallness of the device and the fact that it does not obstruct the flow of air, the instrument is capable of giving accurate readings at a point.

### Determination of Velocity Contours

Readings are made with the tube, and by methods to be described. Velocity contours may be made for any hood. By means of the special mounting, the tube may be moved vertically and horizontally, and fixed at definite points on the axis of the hood. The coordinates at which readings are made are indicated in Fig. 7a. Readings with the tube are taken horizontally, outward from the opening at each level above the center line.

Each reading so obtained is then plotted as shown in Fig. 7b, the ordinates representing the percentage of velocity at the opening and the abscissæ the distance from the opening. The velocity contours may be determined from these curves. For example, to determine the contours of velocities equivalent to 20 and 70% of the average velocity at the face of the opening the values of the abscissæ corresponding to the intercepts are obtained for the various velocity curves, as in Fig. 7b, and plotted as in Fig. 7c.

### Velocity Characteristics of Common Openings

*Simple openings.* The velocity contours and stream lines for simple types of openings often found in practice are shown in Figs. 8 to 12. Thus, provided the region of influence for all round openings is mapped in the coordinate units corresponding to Fig. 4, the velocity contours will all be identical and will be expressed in percent of the average velocity in the plane of the opening. The same is true for the various shaped rectangular hoods where the short side of each is divided into eight units, and the long side in the same units proportional to its length. Therefore, an opening with a ratio of sides of 3 to 4

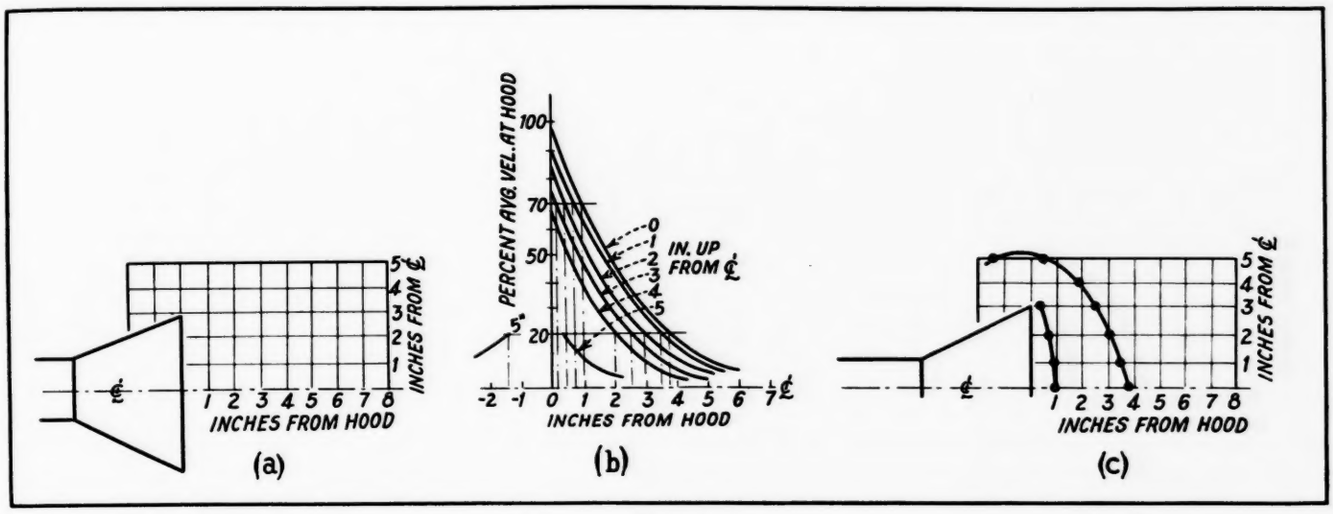



Fig. 7a. Fig. 7b. Fig. 7c.

will have $\frac{8 \times 4}{3} = 10\text{-}2/3$ units on the long side.

An example will illustrate application of the contour lines in Figs. 8 to 12. Suppose it is desired to find the speed and direction of the air movement at a point 4 in. outward and 2 in. upward in the radial plane perpendicular to the short side of a 4 x 8 in. hood handling 640 cfm. The ratio of sides is one-half, and expressing the coordinates of the point on the basis that there are 8 units of length on the short side, the coordinates of the point in question are 8 units outward from the axis and 4 units upward, as shown by the circle in Fig. 11. The velocity at this point is approximately 12½% of the velocity at the opening. Hence, the velocity at the opening being $\frac{640 \times 144}{4 \times 8} = 2{,}880$ feet per minute, the velocity at the point must be $0.125 \times 2{,}880 = 360$ feet per minute. These calculations assume that the flow in the region of influence is not grossly impeded by an obstruction. Otherwise the contours are altered and must be re-determined with the obstruction in place. It may be said, however, that if the obstruction is considerably smaller in cross-sectional area than the surface area of the contours passing through it, the velocity distributions as shown in the figures are not substantially altered. The farther the obstruction is removed from an opening, the less the error involved.

*Flanged openings.* The edge effect noted in Fig. 12 may be reduced by the use of a flange placed around the edge and lying in the plane of the opening. A flange approximately 5 in. in width is sufficient for hoods up to 3 sq. ft. in area. The flange tends to cut off the flow from the region behind the opening (which is frequently useless), and is advantageous in two respects: First, it increases the effectiveness of the hood in the forward regions, and, second, it reduces the energy consumption of the hood.

Figs. 13 to 17 show the velocity contours and stream lines of several flanged openings and for the sake of clearness may be contrasted with the characteristics for corresponding openings shown in Figs. 8 to 12.

*Effect of shape on the distribution of velocity contours.* It may reasonably be supposed that the amount and degree of flaring in a hood have a great effect on the distribution of the velocity contours. However, if it is assumed that the distribution of flow across two openings of the same size and shape are similar, the velocity contours are substantially the same, although the degree of flare differs in each. The main portions of the sphere of influence affected lie behind the edge of the opening, the boundary surface of the flared portion being the chief variable. Thus, the velocity contour distribution may be said to be dependent upon the shape of the opening only, provided the distribution of flow across it does not vary greatly with the degree of flare. In experiments it has been found that over a very wide range the degree of flare alters the distribution of flow across an opening but slightly. Hence, for instance, a 5 x 10 in. opening with a 12-in. flare to a 3-in. diameter duct gives the same contour distribution in

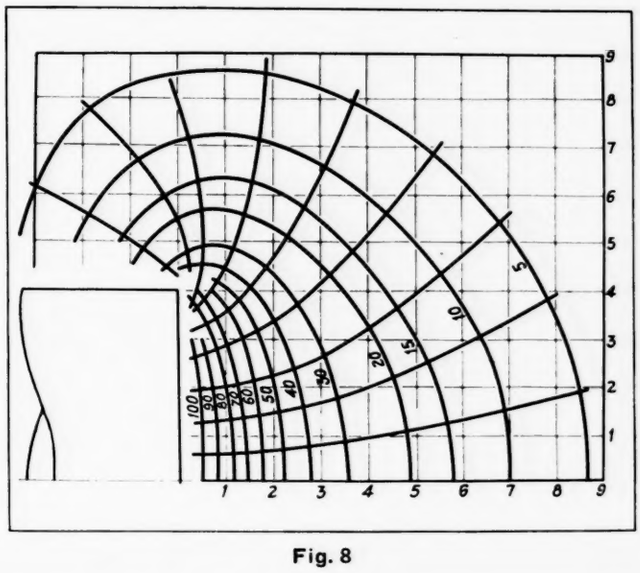
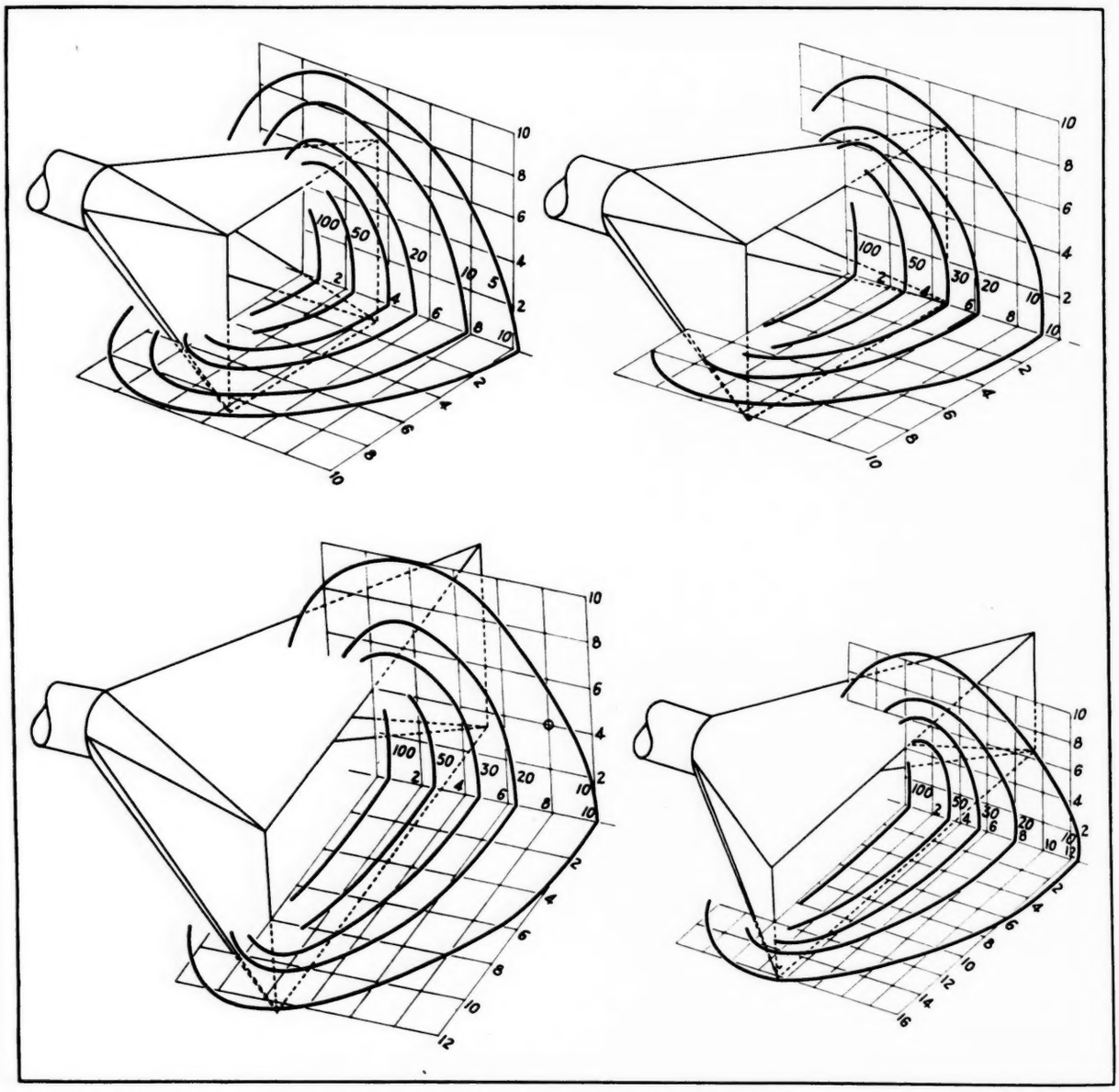



Fig. 8



Top (Left) Fig. 9. Top (Right) Fig. 10. Bottom (Left) Fig. 11. Bottom (Right) Fig. 12.

front of an opening as one with an 8-in. flare to a 5-in. diameter duct. In fact, were the opening only the end of a 5 x 10 in. duct, the velocity contour distribution would differ very little. Since most hoods as a rule are gradually flared in order to reduce entrance losses, when dealing with contour distributions it is practical to express the overall shape of the hood in terms of the shape or form of its opening—that is, in terms of the side ratio.

A matter of some importance is the velocity distribution over the hood opening. In simplifying calculations for developing the contours in Figs. 8 to 17 it has been assumed that the velocity distribution over the opening is uniform. Such an assumption is not correct, as may be judged from an examination of the figures themselves, which show the 100% contour to be somewhat displaced from the opening. In other words, the figures show a velocity higher than the average over the central portions of the opening. The situation is somewhat like the phenomenon occurring when a fluid flows through a pipe, in which there is a higher velocity at the axis than toward the edges due to viscosity. However, in the case of hoods the effect does not arise from similar considerations. In hood openings it is necessary to deal with an edge effect. Air entering from behind the hood is forced to turn into it abruptly, thus creating a stationary vortex which restricts the effective area to a value less than the actual one. At the corner of a rectangular hood the effect may be considered intensified. Experimental data tend to show that the effective area is reduced in proportion to the perimeter of the opening. In the case of a circular duct end without flange, the effect is due to formation of the free stream surface in front of the opening edge.

### Relation Between Opening Area and Velocity Gradient

The data in Table 1 suggest that very little improvement in efficiency can be gained by increasing the open area of the hood, although the average velocity at the opening varies inversely as the area and consequently decreases as the area of the open-

TABLE 1.—VELOCITY CHANGE ALONG AXES OF HOODS OF VARIOUS SIZES WITH CONSTANT AIR FLOW OF 1000 cfm

(Determined from formula $\frac{Y}{100-Y} = \frac{0.1A}{x^2}$)

| Area of opening, (sq. ft.) | Average velocity at opening (ft. per min.) | Distance outward along axis—x, inches | | | | |
|---|---|---|---|---|---|---|
| | | 6 | 12 | 18 | 24 | 30 |
| | | Velocity change, ft. per min. | | | | |
| 1 | 1,000 | 286 | 91 | 43 | 24.4 | 15.9 |
| 2 | 500 | 222 | 83 | 41 | 23.8 | 15.5 |
| 4 | 250 | 154 | 72 | 38 | 22.8 | 15.0 |
| 6 | 167 | 107 | 63 | 35 | 21.6 | 14.6 |
| 8 | 125 | 95 | 53 | 33 | 20.8 | 14.2 |
| 10 | 100 | 80 | 50 | 31 | 20 | 13.8 |
| 20 | 50 | 45 | 33 | 24 | 16.7 | 12.1 |

ing increases. However, there are two advantages of a large hood: First, the entrance loss is lowered by reducing the velocities at the opening, and second, the zone of influence is greatly increased in the regions forward of the opening. Contours having a value of approximately 14 fpm for square openings of various sizes are shown in Fig. 18. It will be noted that the contour corresponding to the opening 20 sq ft in area envelops a much larger area forward of the opening. The total surface developed by the contour is the same in each case, however, since the total flow, Q, is constant ($Q = VA$).

The chief disadvantage of a large opening for dust collection lies in the low rate of air speed change from the point at which the hood is desired to function to its opening. In the collection of dusts, it is highly desirable to have a high rate of change, inasmuch as a dust must not only be arrested at its origin but also conveyed into the hood and to a collecting system. On the other hand, large hoods work successfully in the collection of fumes which require low velocities for their control, and may therefore be handled with a lower consumption of power. It will be shown later that in practice the zones of influence for most hoods are impeded by obstructions, and that it then becomes necessary to alter the treatment of the problem of velocity distribution. However, the factors to hold in mind in any hood installation are the size of the opening and its location with respect to the region over which it is expected to operate.

## Axial Velocities

*Simple openings.* Representation of aerodynamic characteristics of exhaust hoods by velocity contours offers a fairly simple means of comparing various types of hoods graphically. However, the determination of contour lines involves much time and labor. Moreover, velocity contours do not easily lend themselves to mathematical analysis.

A simpler and more direct means of comparison for elementary hoods without obstruction of the opening is the analysis of velocities along the projected axis of openings. Since exhaust hoods ordinarily draw dust from the area directly in front, the chief factor governing their efficiencies is distribution

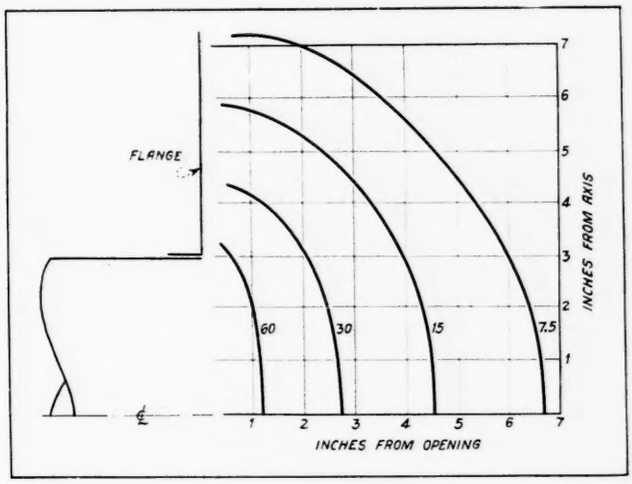



Fig. 13.

of air flow in this region, which may be expressed in terms of axial-velocity curves. A series of curves for several circular openings is shown in Fig. 19. The point velocities are expressed as percentages of the velocity at the opening. As may be seen, the axial velocity curves are limited in one direction and are almost hyperbolic in shape.

The final equation for round openings takes the form

$$\frac{Y}{100-Y} = 0.0825A^{1.04}x^{-1.91} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Expressing A in terms of the diameter d, the equation becomes

$$\frac{Y}{100-Y} = 0.0645d^{2.16}x^{-1.91} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

d and x being in corresponding units, and Y the point velocity expressed as a percentage of the average velocity at the opening.

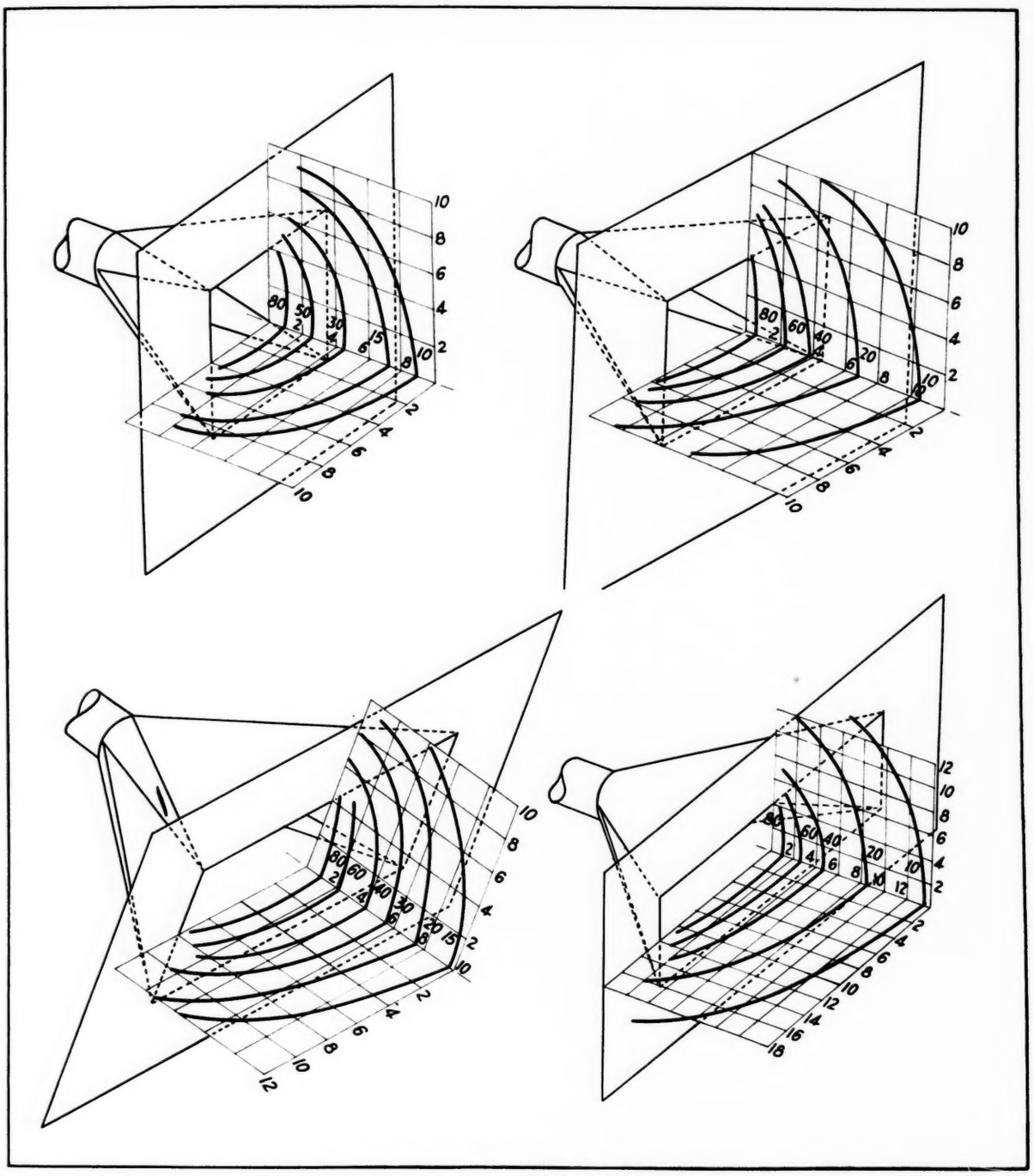
For square and rectangular openings, the velocity at any point along the x-axis may be determined from the following equation:

$$\frac{Y}{100-Y} = \left( \frac{0.0833}{1 + 0.259\left(\frac{1-r}{r}\right)^{1.164}} \right) A^{1.04}x^{-1.91} \qquad (4)$$

where Y = the per cent velocity at the opening found at the point x;
x = the distance outward along the axis measured in any units;
A = the area of the opening in square units; and
r = the ratio of sides (less than unity).

Thus, the center-line velocity curves may be defined completely in terms of the geometric shape and size of the suction openings.

The exponents of $A$ and $x$ in the general equation are close to 1 and 2, respectively. This suggests that the true form of the general equation may be $f(Y) = b'Ax^{-2}$. The following simple formula is suitable for quick and approximate computations of openings usually found in practice:



Top (Left) Fig. 14. Top (Right) Fig. 15. Bottom (Left) Fig. 16. Bottom (Right) Fig. 17.

$$\frac{Y}{100 - Y} = \frac{0.1A}{x^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Equation 5 may also be written so as to give the velocity at a point along the axis directly in terms of the air flow $Q$, since $Y = \frac{V}{V_o} \times 100$ where $V_o$ is the average velocity at the opening and $Q = AV_o$, $A$ being the area of the opening. Thus*

$$V = \frac{0.1Q}{x^2 + 0.1A} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

It is interesting to note that this equation for values of $x^2$, which are very large in comparison with 0.1A, gives the relation

*Since submitting the manuscript of these articles for publication further important work on the subject by Silverman has appeared. At the time the original work on centerline velocities and velocity contours was undertaken (1928-1929) only the cylindrical pitot-static tube was available for measuring point velocities. Silverman has shown how this tube, calibrated in the usual manner, may be subject to serious errors (errors of coefficient) when used in a free-flowing air stream. He therefore used a thermometer-anemometer in his investigations. In addition to the ease in applying this instrument to point-velocity determinations, it possesses far greater sensitivity than the cylindrical pitot used in my original studies. While I do not agree with Silverman's values obtained at relatively great distances from the opening ($x/A > 2.0$), I am very glad to publish his corrections to formula (6). These are as follows:

For ordinary round openings $V = \frac{Q}{4.45x^2 + A}$

and for flanged round openings $V = \frac{Q}{3.1x^2 + A}$

Silverman has also given a more precise equation for centerline velocities for unflanged round openings which within the limits specified is quite accurate. This is $V/V_0 = 0.17\ (A/x)^{1.5}$, the terms being as defined in the text.

While I am still uncertain as to the effects of Silverman's corrections on the values of the velocity contours (Figures 8 to 17), it would seem that on the basis of his centerline velocity results the values there given are roughly 20% too low. However, the general shape of the contours are correct since they are independent of the cylindrical-pitot calibration.—J. M. Dalla Valle.

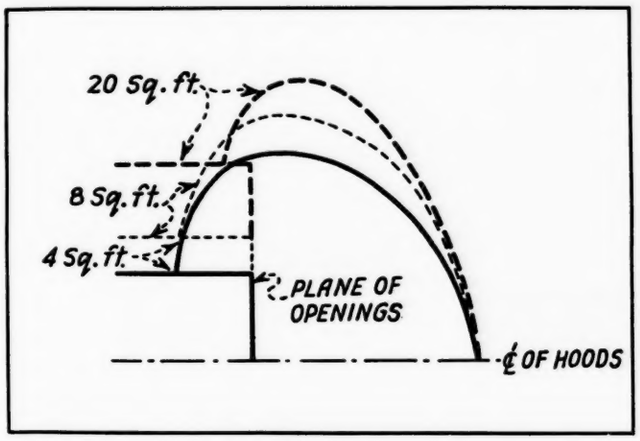



Fig. 18.

$$V = \frac{0.1Q}{x^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

which is identical with Equation 1 deduced from elementary considerations, with the exception of a larger constant in the present instance.

The nomograph of Fig. 20 has been prepared and gives the value of $Y$ when $x$ and $A$ are known. To use this nomograph a ruler is connected between the values of $x$ and $A$ given, and the value of $Y$ read off at the intersection with the middle scale. The line drawn in the figure connects a value of $x$ of 10 units with an area of 150 square units, giving at the intersection with the middle scale a value of $Y$ equal to 15%. In other words, the velocity at a distance of 10 units from an opening 150 units square is 15% of the velocity at the opening.

A simplification of Equation 4 can be obtained by writing

$$\frac{Y}{100 - Y} = b\, A^{1.04} x^{-1.91} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Values of $b$ are given in Table 2. Equation 4 may then be determined simply by substitution of the value of $b$, corresponding to the ratio of sides $r$ in Equation 8.

*Flanged openings.* Equations 2 and 8 were derived from linear plots of experimental data on logarithmic grid. By inverting the typical center line velocity curves shown in Fig. 19, and plotting on log-logistic grid, the data also plotted as straight lines for both plain and flanged openings. The resultant equation fitted to all data obtained was of the form

$$Y = 100 \left( 1 - \frac{1}{1 + e^{-n\,(\log x - \log x_0)}} \right) \quad \ldots\ldots\ldots (9)$$

TABLE 2.—VALUES OF b FOR VARIOUS SIDE RATIOS r

| Ratio of Sides r | Value of b | Ratio of Sides r | Value of b |
|---|---|---|---|
| 0.1 | 0.020 | 0.6 | 0.071 |
| .2 | .037 | .7 | .075 |
| .3 | .049 | .8 | .078 |
| .4 | .059 | .9 | .081 |
| .5 | .065 | 1.0 | .083 |

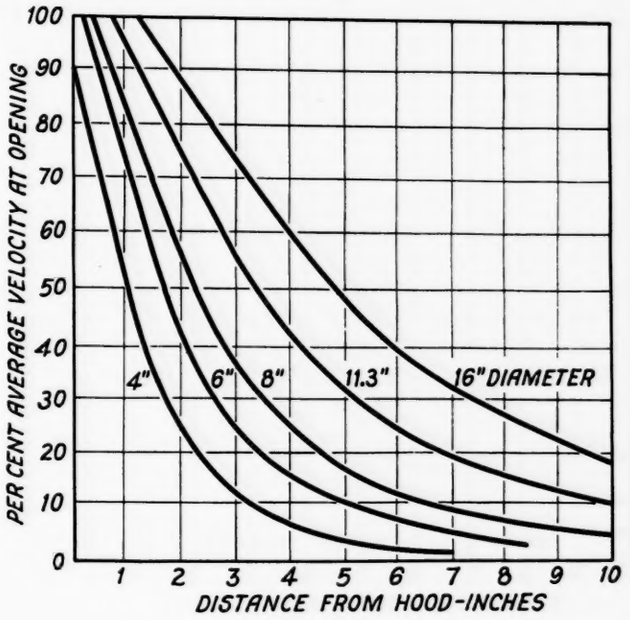



Fig. 19.

where $Y$ and $x$ have the same meaning as before and $e$ is the base of the natural system of logarithms, 2.718. The exponent $n$ was found to have a value 4.4 for plain openings and 3.5 for flanged openings. The parameter log $x_o$, however, was found to be the same for both types of openings, being given by the equations*

$$\log x_o = -0.624 + 1.09 \log d \quad \ldots\ldots\ldots\ldots\ldots (10a)$$

for round openings, while for rectangular openings

$$\log x_o = -a + 0.545 \log A \quad \ldots\ldots\ldots\ldots\ldots (10b)$$

where $d$ and $A$ correspond to the units chosen for $x$. The values of $a$ in Equation 10b for side ratios ranging from 0.1 to 1.0 are given in Table 3.

## Simplification of Center Line Equation for Flanged Openings

Equation 9 can be shown to be of the same type as Equation 8. In fact, Equations 8 and 9 are almost identical. To prove this, it is merely necessary to transfer and regroup terms in Equation 9, so that we obtain

$$\frac{Y}{100 - Y} = e^{\frac{-n \log x}{x_o}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

Taking logarithms of both sides to the base $e$,

*Logarithms are to the base 10.

TABLE 3.—RELATION BETWEEN RATIO OF SIDES OF FLANGED RECTANGULAR OPENINGS AND VALUE OF a AS GIVEN BY EQUATION 10b

| Ratio of Sides | Value of a | Ratio of Sides | Value of a |
|---|---|---|---|
| 0.1 | 0.89 | 0.6 | 0.60 |
| .2 | .76 | .7 | .59 |
| .3 | .68 | .8 | .57 |
| .4 | .64 | .9 | .57 |
| .5 | .62 | 1.0 | .56 |

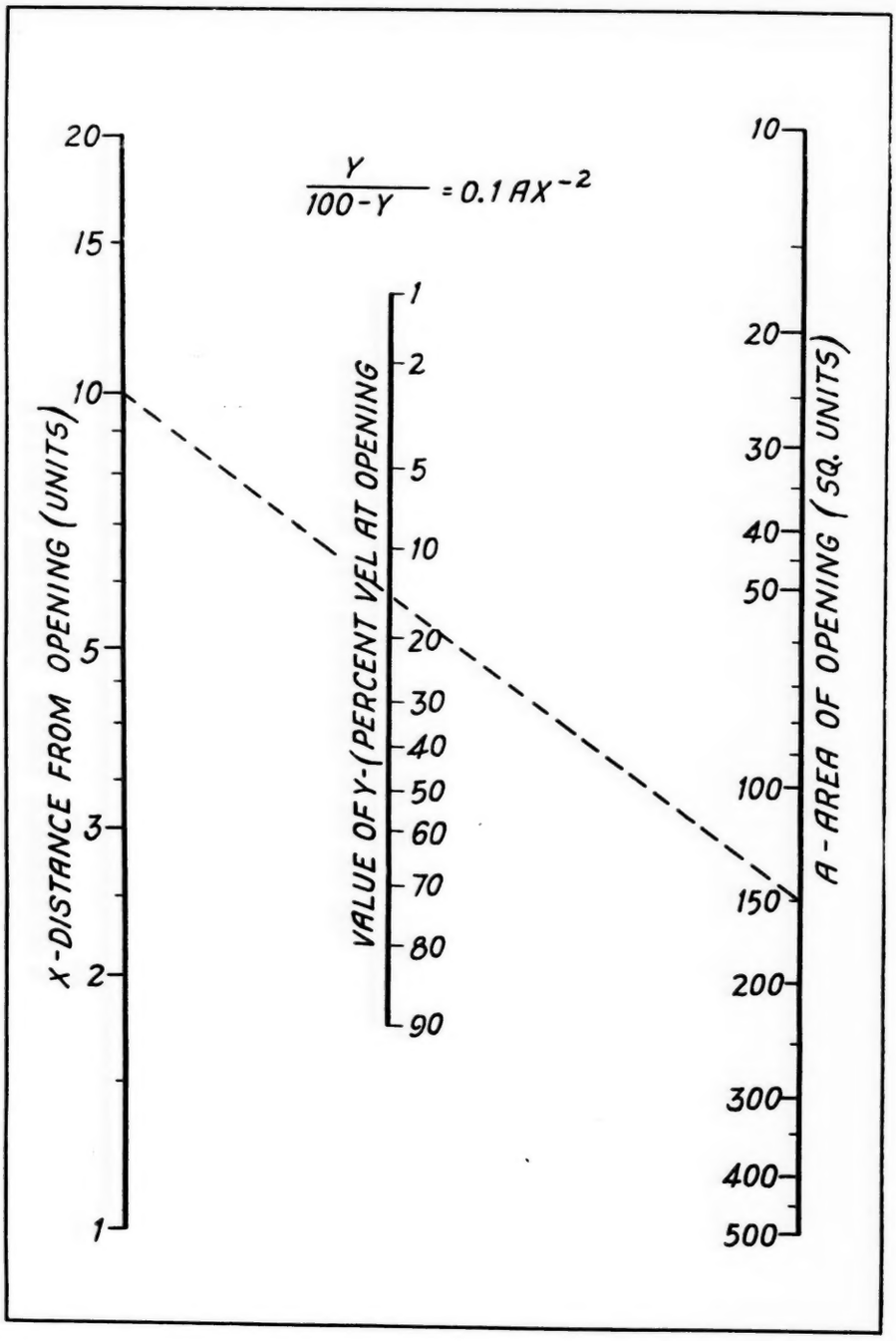



Fig. 20.

$$\log_e \frac{Y}{100-Y} = -n \log \frac{x}{x_o}$$

and changing the left-hand portion of this equation to the base 10

$$2.3 \log \frac{Y}{100-Y} = -n \log \frac{x}{x_o}$$

For simple openings, n = 4.4 so that

$$\frac{Y}{100-Y} = \left(\frac{x_o}{x}\right)^{1.91} \quad \ldots\ldots (12)$$

Now $x_o$ is given by the equation

$$x_o = cA^{0.545} \quad \ldots\ldots (13)$$

where $c$ is a constant, as may be seen by reference to Equation 10b. Hence, Equation 11 above may be written

$$\frac{Y}{100-Y} = bA^{1.91} x^{-1.91} \quad \ldots\ldots (14)$$

which is identical with Equation 8 in the text ($b = c^{1.91}$). Equation 11 for circular openings reduces to Equations 2 and 3, expressed either in terms of the area $A$, or the diameter $d$.

When the opening is flanged, the axial velocity relationship as given by Equation 1 can also be reduced to a form similar to Equation 2 with the exception that $n$ now is equal to 1.5, that is

$$\frac{Y}{100-Y} = \left(\frac{x_o}{x}\right)^{1.5} \quad \ldots\ldots (15)$$

$x_o$, however, is also given by Equation 3, so that

$$\frac{Y}{100-Y} = c'A^{0.82} x^{-1.5} \quad \ldots\ldots (16)$$

Values of $c'$ are given in Table 4 for various side ratios. These values are easily derivable from the values for $b$ and $a$ given in Tables 2 and 3.

TABLE 4.—VALUES OF c′ FOR VARIOUS SIDE RATIOS r

| Ratio of Sides r | Value of c′ | Ratio of Sides r | Value of c′ |
|---|---|---|---|
| 0.1 | 0.046 | 0.6 | 0.126 |
| .2 | .072 | .7 | .130 |
| .3 | .095 | .8 | .140 |
| .4 | .090 | .9 | .140 |
| .5 | .117 | 1.0 | .144 |

## Generalization of Center Line Velocity Equations

The methods of dimensional analysis permit expression of the center line velocity equations in a rational form. Let

$$\frac{V}{V_o - V} = f\ (b, A, x) \quad \ldots\ldots (17)$$

where $V_o$ is the average velocity at the plane of the opening, and $V$ the velocity at the point $x$. The value of $b$ depends upon Reynold's number $\frac{V_o x}{v}$, where $v$ is the kinematic viscosity, $\mu/\rho$, and a constant, b′, called the opening shape factor. Equation 17 may thus be written in a generalized form

$$\frac{V}{V_o - V} = b' \left(\frac{V_o x}{v}\right)^s \cdot \frac{A}{x^2} \quad \ldots\ldots (18)$$

where $s$ is an exponent having a value of less than 1. Equation 2 may be further generalized to

$$\frac{V}{V_o - V} = b' \left(\frac{V_o}{v} \cdot \frac{A^n}{A^n}\right)^s \cdot \frac{A}{x^{2-s}} \quad \ldots\ldots (19)$$

where $n$ is also an exponent having less than 1. But we know from experiment that the true relationship of the velocity along the axis of a plain opening is

$$\frac{V}{V_o - V} = b \frac{A^{1.04}}{x^{1.91}}$$

Hence, s = 0.09 and n = 0.45 and Equation 19 becomes

$$\frac{V}{V_o - V} = b' \left(\frac{V_o}{v A^{0.45}}\right)^{0.09} \cdot \frac{A^{1.04}}{x^{1.91}} \quad \ldots\ldots (20)$$

or to an excellent degree of approximation

$$\frac{V}{V_o - V} = b' \left(\frac{V_o}{v\sqrt{A}}\right)^{0.1} \cdot \frac{A}{x^{1.9}} \quad \ldots\ldots (21)$$

Following the same procedure as above, the equation for flanged openings may be written

$$\frac{V}{V_o - V} = c'' \left(\frac{V_o}{v A^{0.36}}\right)^{0.5} \cdot \frac{A^{0.82}}{x^{1.5}} \quad \ldots\ldots (22)$$

where $c''$ is a shape factor constant for flanged openings.

Equations 20, 21, and 22 hold for any non-compressible fluid at any temperature. For practical purposes air may be regarded as non-compressible in application of the above equations. The center line velocity equations given in the text hold for a temperature range of 70 to 80F.

## Relation Between Size of Hoods and Connecting Ducts

The distribution of air flow over the hood opening should be as uniform as possible. This cannot be secured when the ratio of the area of the hood opening to the connecting duct area is large, unless the length of the transition piece is increased to accommodate the change in air speed from section to section. Otherwise, the movement of the air will all be concentrated at the center of the hood opening, and the hood will fail to function properly. Unless there is an even distribution of air flow across the opening, there is little sense in maintaining the full-size hood.

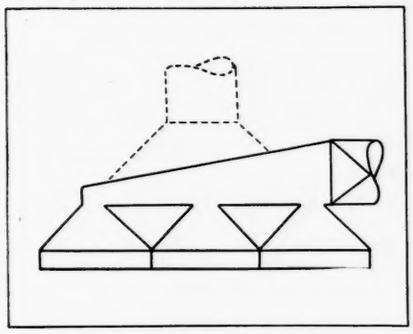


Fig. 21.

There are many instances where a high ratio between the size of the opening and the connecting duct is necessary, and yet a long flare cannot be used for lack of space. In such cases, the hood may be designed so that it is divided into several hoods, edge to edge, each of which is independent of the other. A large hood with a side ratio of 1 to 3, for example, may be divided into three square openings connected as indicated in Fig. 21, thus effecting a considerable saving in head room over that occupied by a transition piece of the common type.

It is not possible to formulate a definite rule governing the relationship between the ratio of the areas of connecting duct and hood opening, and the degree and length of the flare. In modern practice the ratio is generally taken as 1 to 16 at a maximum, and the length of flare as three times the diameter of the connecting duct.

The size of the connecting duct is also determined on the basis of the air velocities necessary to convey the material collected. Gases and vapors require

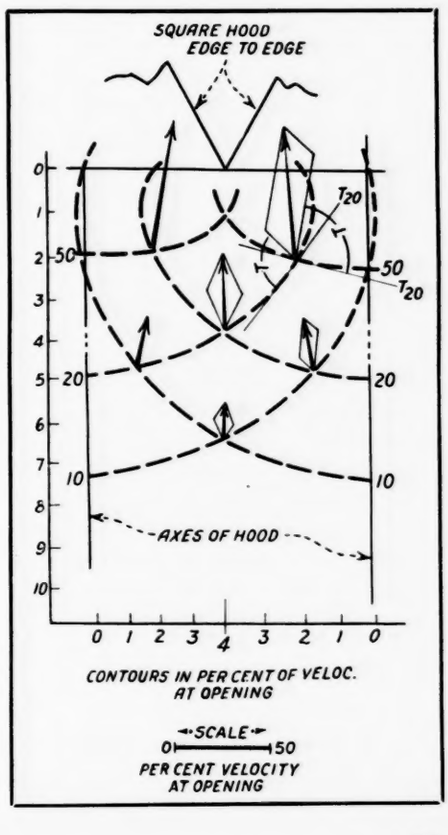



Fig. 22.

TABLE 5.—AIR SPEEDS IN DUCTS NECESSARY TO CONVEY VARIOUS MATERIALS

| Material | Air Velocities Feet per Minute |
|---|---|
| Grain dust | 2,000 |
| Wood chips and shavings | 3,000 |
| Saw dust | 2,000 |
| Jute dust | 2,000 |
| Rubber dust | 2,000 |
| Lint | 1,500 |
| Metal dust (grindings) | 2,200 |
| Lead dusts | 5,000 |
| Brass turnings (fine) | 4,000 |
| Fine coal | 4,000 |

velocities ranging from 1000 to 2000 feet per minute. Larger duct sizes are preferable in order to reduce friction losses. However, small ducts and high velocities provide more effective and certain removal, and are more frequently in practice.

In the case of dust, velocities must be sufficiently high to prevent settling. At the same time, velocities which are too high may make the losses due to friction excessive.

There is very little information on values of transport velocities. Some data for ducts which have been found practical are given in Table 5, but whether they are the most economical cannot be stated. No data regarding the size of the particles or their characteristics are available, and in all probability the figures represent velocities in accordance with existing practice. However, when the maximum size and density of a particle to be conveyed are known, the following formulæ for horizontal and vertical transport are useful.

For horizontal ducts:

$$V = 6{,}000 \frac{s}{s+1} d^{0.4} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (23)$$

and for vertical ducts:

$$V = 13{,}300 \frac{s}{s+1} d^{0.6} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (24)$$

where $V$ is the air velocity in feet per minute, $s$ is the specific gravity of the particles, and $d$ is the diameter in inches of the largest particle to be conveyed. The velocities determined by the above equations are minimum and should be increased approximately 10% to prevent settling, which is likely to occur at elbows or enlargements.

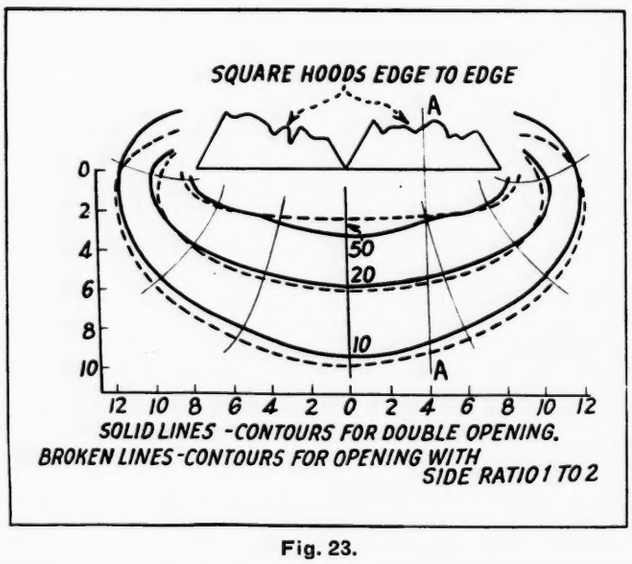



Fig. 23.

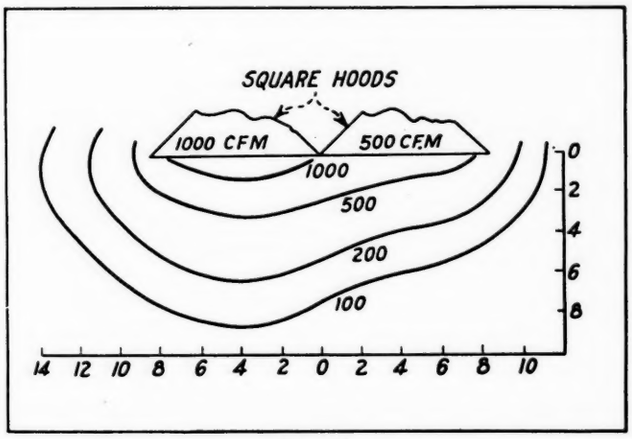



Fig. 24.

## Determination of Velocity Contours for Compound Hoods

When hoods are subdivided in the manner indicated above, the velocity distribution is not changed materially from that given by the single large opening.[3] The contour distributions for two square hoods placed edge to edge may be combined vectorially at their intersections, as shown in Fig. 22. From the resultant velocities and directions of the air movement thus obtained, a new set of velocity contours may be drawn. This has been done in Fig. 23, where the solid lines indicate the contours obtained by the principle of velocity combination, and the dotted lines represent the distribution for a single opening whose side ratio is 1 to 2. The proximity of correponding contour values indicates that the subdivision of a large hood into independent units of smaller dimensions does not alter the original velocity distribution of a hood.

This way of combining square hoods, edge to edge, may be employed in establishing the velocity contours for any side ratio, although the method is laborious. It may also be applied to the study of arrangements in which velocity distribution is not uniform, such as the double hoods recommended for control of fumes by some state codes. In Fig. 24 are shown the velocity contours for two square openings, edge to edge, one of which is handling twice as much air as the other. As may be seen, there is considerable distortion although it is not difficult to show that there is a slight reinforcement. Studies of this sort suggest that double hoods do not possess marked advantages over the well-designed single hood.

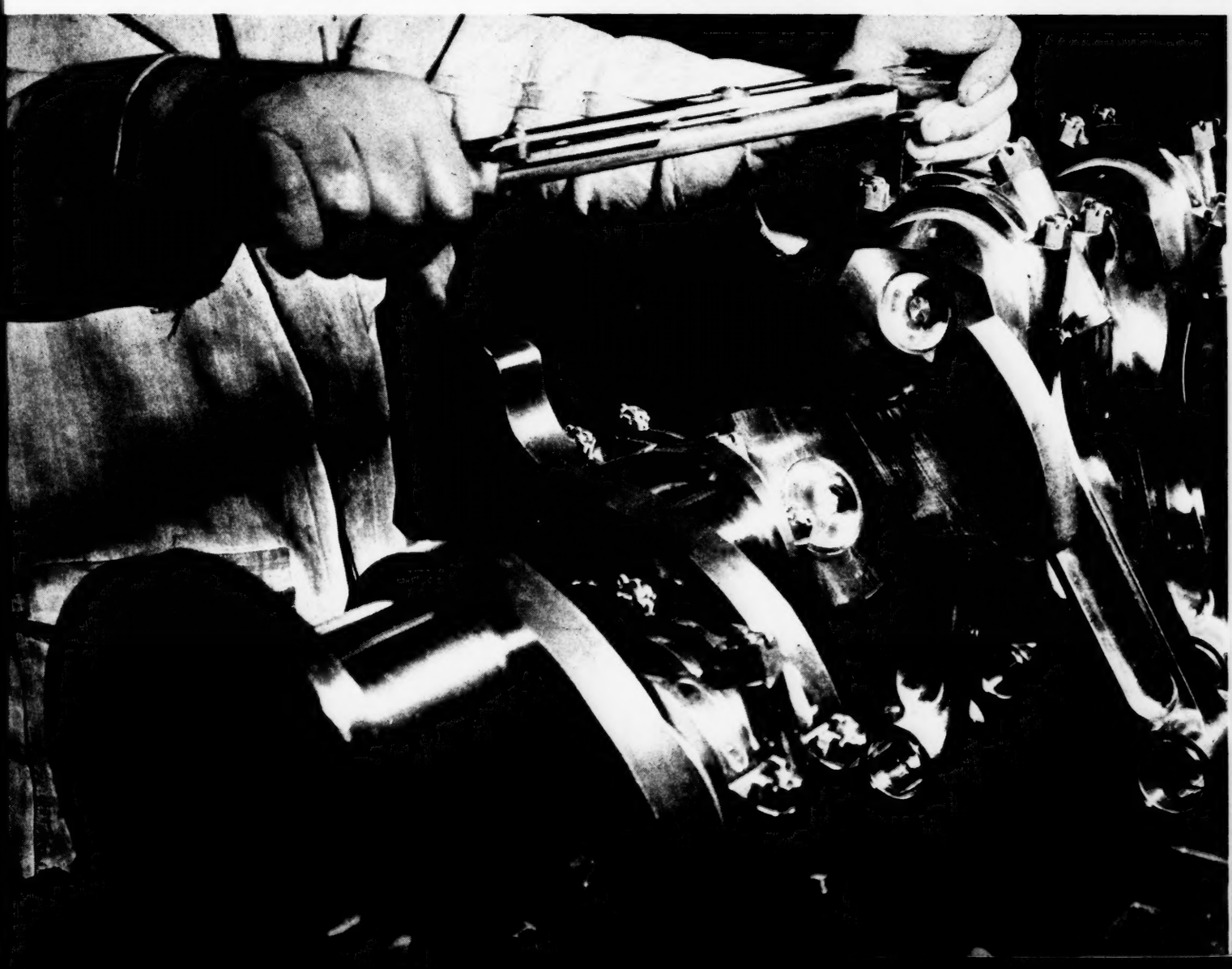
*(Next month's installment will discuss velocity contours of hoods with special boundary conditions.)*

[3]U. S. Public Health Service, 1935: Determination and Control of Industrial Dust, J. J. Bloomfield and J. M. Dalla Valle, Bulletin 217.

# PROFITS IN AIR

## HOW INDUSTRIAL PLANTS PROMOTE PROCESSES BY CONTROL OF AIR CONDITIONS

Photo through courtesy of Office of War Information (by Palmer), Washington, D. C.



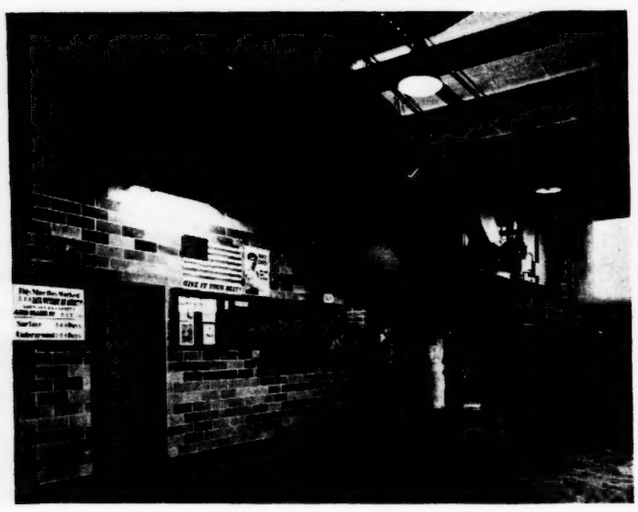
# MATHER MINE

**PROFITS IN AIR**
HOW INDUSTRIAL PLANTS PROMOTE PROCESSES BY CONTROL OF AIR CONDITIONS

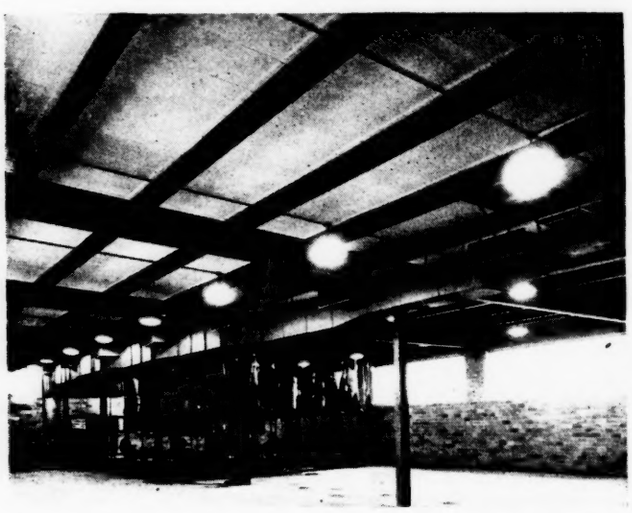
## sets new standard in comfort facilities for miners. Modern change house has effective ventilating system, promotes health and efficiency of workers.

MINERS engaged in sinking the shaft for the Negaunee Mine Company's new Mather Mine, which will be one of the large producers of the Lake Superior region, are enjoying conveniences which have set a new standard for the whole mining industry. The change house, into which the men are ushered direct from the 75-man double deck elevators which bring them up from the mine at the end of each shift, is the last word in cleanliness and comfort. Here in a dry, sanitary, comfortably-heated and well-ventilated room, they can quickly change to street clothes and go home clean and refreshed after the day's work.

Surface facilities at the mine, which is owned jointly by the Cleveland-Cliffs Iron Company and the Bethlehem Steel Corporation, were designed and



**The unit suspended above the lamp checker's counter automatically supplies clean air at the proper temperature to the entire change house through the duct.**



**A continuation of this duct supplies filtered warm air to the dirty clothes room through the grilled outlets shown. Dry, sanitary, healthful conditions are easily maintained.**

built by The Austin Company. They include a small air-conditioned office building of brick with Indiana limestone trim; a maintenance and warehouse wing; a large machine room; and the change house, size 60 by 280 ft, with a 130-nozzle shower room between the isolated quarters provided for clean and dirty clothes.

Separate accommodations have been provided for mine and surface crews, which will ultimately total approximately 1000 men on three shifts. The use of salt-glazed tile on all wall surfaces and glass block instead of windows, has made it possible to wash sidewalls as well as concrete floors throughout the change house with high-pressure spray hose, in the interest of constant cleanliness. There are no windows in this area, where special automatic ventilating systems provide proper temperature at all times.

In the interest of heating efficiency through the long cold winters, a two-inch air space has been provided in all exterior walls to reduce heat losses. There is an eight-inch outer wall of brick all around, with two-inch air space between it and the interior wall, which is acoustic cinder block in the case of the machine room, glazed tile throughout the dry house, hollow tile in the maintenance shops, and plaster in the office.

In the offices and other locations where sash was used, double windows were installed with an air space between. The interior unit is removable and is fastened to the exterior unit, with a rubber gasket between, to prevent infiltration of iron ore dust between the sash.

The mine shaft is now being sunk to a considerable depth and is to be deepened as conditions warrant. Ore will be hoisted in two skips, having a capacity of 12 tons of ore each. These will be operated in balance.

The steel headframe of the shaft erected by Warden-Allen Company extends 200 ft above ground and has been equipped with a passenger elevator to take men to the stocking trestle platform and various other points for maintenance work.

# American Magnesium Corporation

**solves problem of dust settling in molds by installing heating and ventilating system**

A new solution to the old foundry problem of free dust and sand settling into molds and causing casting rejects has been found by the American Magnesium Corporation in its Cleveland foundry. The solution lies in a new heating and ventilating system which, by means of amount, direction, and rate of air delivered, prevents dusts from being blown about and dilutes the unpleasant smoke-laden atmosphere.

The equipment used consists of ten Thermadjust heat diffusers, supplying 135,000 cfm of outside air to the foundry. Although the foundry is 80 ft wide, 160 ft long, and 35 ft high, the units maintain comfortable working conditions.

Mounted in an inverted position along the side walls, the heating units are nine feet above floor level. From long slotted outlets, a low velocity flow of outside air is fanned downward and toward the center of the floor at the correct temperature to offset heat losses through the ventilators.

One of the advantages claimed for the system is that overblows, which swirl dust and other impurities around the foundry without forcing them toward the ventilators, are eliminated by discharging the air at low velocity.

# Ordnance Plant

**shortens time between powder and ultimate shell loading by use of dehumidifier.**

The time gap between powder and ultimate shell loading at a Southern ordnance plant has been reduced by several hours as the result of a recent installation of silica gel dehydrators.

The shell loading plant, operated by Silas Mason Company, consists of a variety of buildings housing three powder and shell production lines, powder drying houses and storage and shipping buildings. Two production lines are equipped with dehydrating air conditioning units, and others will be changed over with later plant expansion. One of the production lines loads 37 millimeter shells for anti-aircraft and anti-tank use; on the other percussion primers are stamped on the shells.

Major equipment consists of two rotary-type Carrier dehydrators, which are at present drying black powder. Used in connection with these units are two four-compartment dryers. Powder for shell loading is placed on flat trays in the dryers and conditioned air is circulated over and around the trays from the dehydrator. A low humidity of 5% or less, required for drying powder to a maximum efficiency, is consistently maintained. Drying capacities will be increased as production facilities are added to the lines.

# *Westinghouse Lamp Division*

**PROFITS IN AIR**
HOW INDUSTRIAL PLANTS PROMOTE PROCESSES BY CONTROL OF AIR CONDITIONS

## finds complete air conditioning indispensable in manufacture of delicate electronic tubes. Dust-free moisture-controlled atmosphere insures high quality.

A NEW electronics workshop, hospital-like in cleanliness, with gleaming white machinery and a brilliant ultra-modern lighting system, has been put into operation at the Westinghouse Lamp Division to produce electronic equipment for the armed forces. Protected from the tiniest particles of dust and moisture, delicate electronic tubes, such as those for high power radio transmission, are assembled by the several hundred men and women employed in the new laboratory. Many of the precautions of a hospital have been adopted to assure absolute cleanliness which is all-important in the production of an efficient electronic tube. Clean white cotton gloves are issued daily to workers on certain operations. The gloves are worn so that no moisture from a workman's hands can touch the delicate tube parts. This added precaution is taken although the laboratory is completely air-conditioned and humidity-controlled. Some jobs require only one glove and others none at all. To avoid the problem of matching pairs, a glove is used that will fit either the right or left hand. About 10,000 gloves are required every month to supply the needs of the laboratory.

In the assembly of vacuum tubes freedom from moisture or dust is of extreme importance. A tiny particle of moisture on a tube part collects grease. Then when the tube is heated, the grease vaporizes leaving particles of dirt which may interfere with the efficient operation of the tube. Floors, walls, ceilings and work benches are kept a spotless white. Dirt or dust stands little chance of going undetected under the most modern fluorescent lighting. The light surroundings have a good psychological effect, employes in the laboratory make every effort to keep the rooms clean, and many wear white uniforms.

The new 3-room electronics workshop is divided into two departments, the mounting department employing over 100 girls in assembling the operating mechanisms of electronic tubes, following which the tubes are sealed by glass blowers in the sealing department. The laboratory is windowless to exclude dust or excess humidity. Good housekeeping is an iron-clad rule, this modern workshop being cleaned once each day and walls washed continuously. When the electric washing apparatus has completed the circuit, it begins all over again.

**(Left) In this air conditioned and spotlessly clean workshop, delicate electronic tubes such as those used in military communication equipment are assembled. (Center) Gloves protect the tubes against hand moisture while being lowered into the annealing pot where a temperature of 980F relieves strains in the glass. (Right) The ancient art of glass blowing is used in the sealing-off operation. This encloses the 500-watt radio transmitting tube in an air-tight glass envelope.**

# What's the Matter with Air Conditioning as Tomorrow's Method

By LESTER T. AVERY
President, Avery Engineering Co.
Cleveland, Ohio

**Last August HEATING AND VENTILATING published an article suggesting that improved forms of panel heating and cooling might well be tomorrow's method for providing comfort conditions. The accompanying comments are a challenge to some of the statements made in that article; they were written not long after Mr. Boester's article appeared but, due to a heavy schedule on our part, have been delayed in publication—for which we apologize to the author and our readers.—EDITOR**

"PERHAPS he has overstated the case." *That* is certainly an exaggeration of understatement. It does light a fire in my back yard, however, and prompts me to take out the new portable and try to put into words a few ideas I have about the cost of air conditioning.

The quotation above is from the editor's comment to the article by Carl F. Boester "Is This Tomorrow's Method of Heating and Cooling?" which appeared in HEATING AND VENTILATING. I have a very great respect for Mr. Boester's opinion as an engineer, and in taking issue with his premises and his conclusions, I do so only because his article is so good and so plausible, I want to see if there are any holes in it.

We have an unwritten rule around our outfit. It is that if two of our engineers disagree, one must sell the other, for no plan is to be followed simply because it is standard practice, or because one engineer has more authority than the other. It is in this spirit, therefore, that I approach the subject of cost of air conditioning from an entirely different point of view than that of Carl Boester. I feel that *the allegedly high cost of air conditioning is* NOT *the reason why its use is still limited, particularly in residences!*

In the midst of a war for survival, for the preservation, if you like, of our American standard of living, which does include among other things more air conditioning installations for comfort than all of the rest of the world combined, it is fitting that we calmly think this thing through, so we may better know where we are going when we have won the war. Possibly we can be more honest with ourselves and our public now when we can no longer secure the equipment for comfort air conditioning. As a matter of fact a great many air conditioning sales for increasing industrial efficiency have been sidetracked because our story has not been clear or convincing to the men responsible for allocating critical materials.

And it is not the cost that is the crux of the matter. Rather, it seems to me, it is the very mediocre results and even definitely bad conditions that have been the end use of many of these installations, together with a lack of understanding of limitations of equipment, both on the part of the purchaser and of the seller.

For example, last summer in northern states was particularly bad from the standpoint of high humidity and low temperature. Where refrigeration was used for cooling the compressors would not run long enough to dehumidify. Polished metal parts, whether of machine tools or products in process, tarnished, and even rusted. Bypassing wouldn't help, in fact in many cases it aggravated the trouble. Reheating was the only cure, but very few admitted it and fewer still had planned to use it. Simple evaporative cooling systems were that much worse and the water pumps were shut down. Small wonder, therefore, that by the end of August WPB ruled that it would allow no more air conditioning in industrial plants except for process. In process work, gauge and other laboratories, and other quality installations, the reheating is *always* provided or chemical dehumidifying is included, both having a similar end result. These types of installations did deliver and are still to be installed and depended upon.

The point in exposing this dirty linen is to emphasize that it was the effort to buy or sell *lower cost* air conditioning systems which made the compromises necessary, with the result that the equipment did not fulfill the purpose for which it was installed. Do you think air conditioning would have been ruled out of the industrial plants working 24 hours a day, 7 days a week, if it had *unquestionably* improved production both in quantity and quality? Of course not! But, on top of this trouble with rust on the parts, there were complaints from the men because of drafts. Here again the effort to reduce cost boomeranged. If there is one place you can't cheat it is in air distribution.

You might say I am proving the point that it is better to use panel cooling and heating, thus eliminating the air-borne troubles. I don't admit this at all. On the contrary, it seems to me that panel heating or cooling must go uphill all the way to justify its existence. I am familiar with Dr. Mills' hopes on the subject of panel cooling and have read the many enthusiastic articles on the subject of radiant heat. It is not economical to apply the panel

heat in the outside wall because of the increased cost of insulation and excessive operating cost for heat. If you do not heat the outside wall, panel heating falls on its face. And you *must* provide ventilation. And if you *circulate* air you can take the excess heat due to sun or open fire or lights from one room or zone to the other rooms or zones needing heat. Therefore, a properly designed forced air heating system will cost less to install and operate than an equally properly designed panel heating and ventilating system. That statement will stand until authoritative cost and test data are presented to show otherwise.

But what of panel cooling? Have you ever seen any? For one thing it is an economic monstrosity because here again the outside wall must be cooled and the cost of insulation and operating cost would be excessive. In the temperate zone, where a large part of comfort air cooling is used, *dehumidifying* can't be laughed off. As mentioned above, the failure properly to dehumidify may mean the complete failure of the system. Ventilation air must be planned on and delivered and conditioned. Moisture loads of people and product and infiltration are there whether you wish them to be or not.

Panel cooling is simply exaggerating a very important factor which is all too often neglected—the heat load due to sun on walls and windows. Many installations are flat failures because the zone near outside walls is unduly warm from the panel heat of the sun, and you can't argue a person out of it by telling him the air temperature is 80F. Get an instrument that will absorb the radiant heat from wall or venetian blind the same as a person's body does and then see what the effective temperature is. The cure is not panel cooling of the outside wall, but rather proper insulation and sun protection. If there is any successful panel cooling system now installed that can be inspected let's hear about it. For ten years we've heard about it as a wonderful idea and probably the "tomorrow's method." It seems still to be in the nebulous stage of wishful thinking and may prove to be a delusion and a snare.

The question of cost cannot be lightly dismissed. Those of you who have been connected with this industry since the boom in the twenties in theater air cooling know how tremendously costs have been reduced for similar installations—$25 per seat down to $10—and a better job of air distribution and control at the lower figure. (Incidentally, how would you apply panel cooling to a theater? Who radiates what to whom?) Similarly, the cost for restaurant cooling has gradually come down from $40 per seat to $16, although in many cases ventilation has been sacrificed.

You can *add* the summer cooling and dehumidifying to a warm air system for a modest cost, say $800 for an eight-room house, and roughly $100 per room for extra rooms. That cost amortized over the life of the house is only $50 per year, plus maybe $25 per year operating cost. Thus you can see the cost of ownership and operation is really very low when compared with other refinements of living. Was the automobile sold because it was cheap, or because it gave better and personalized transportation? Compare the present day Ford for example with the 1914 model that sold around $600. Why are you willing to pay more now than you would then? Isn't it because you are ready, willing, and able to pay a fair price for a product which produces as near perfection as you expect? And you have no use for almost results at any price.

We have seen this clearly illustrated with room coolers. Two years ago, when plenty were on the market, dealers cut prices and yet did not secure volume sales. Last year units sold for list prices—$258, for example, for the same unit that went begging (cut price) at $177 the year before. People want perfection, not low prices. The sales that bounced were generally of two types—too noisy, or too high humidity on sultry days. Some people would come back for a larger unit or would buy two small units for one room once they had the taste of what comfort cooling was like in their own home or office. The larger units, ¾ hp at $495, were *more in demand* than the ½ hp units at $258, and the 1/3 hp at $167 were almost unsalable as they would serve only the smallest room. Room cooler business can be killed and has been retarded by underselling rather than high cost. I submit that any individual or firm that has the opportunity to sell the public comfort cooling for home or office has an obligation and a responsibility far beyond that of other mechanical equipment of similar cost. The end result must be just as quiet, just as dependable, just as adequate, just as personal as the automobile he bought for personal transportation. We simply cannot compromise with the end result to get a low cost.

What are we going to do with the plants and personnel after the war is won and war production stops? Are we going to sacrifice the comfort cooling or so-called air conditioning business on the altar of low cost and expediency? Or shall we fill the tremendously real demand for personalized air temperature and humidity and purity and ventilation control? The worker who has good air conditioning in the shop will pay for it at home. The office worker who eats in well-conditioned restaurants and goes to comfortable movies will pay for it at home and demand it of the boss at the office. Summer cooling will be just as common as winter heating is now.

Hundreds of thousands of men and women can be used to build and install this equipment. What other refinement in living holds equal promise in useful work and increased comfort and health? Is it really a matter of first cost, or is it rather the setting of standards by ourselves for ourselves to bring air conditioning to the same high level that the automobile has reached in personal transportation? If we are honest with ourselves we will have to admit to some terrible sins of omission and commission in the name of air conditioning, and even plain heating and ventilating, for that matter. This

industry is not waiting for some radical new method such as panel heating or cooling. It is crying for a little more plain straight thinking, and greater integrity in its dealing with the public. Tomorrow's method of heating and cooling will be the very best method we can develop, and the cost will be gladly paid by a pleading purchaser. He wants *perfection.* Shall we deny him?

# Hot Water Tank Hook-Ups

The accompanying diagrams are useful for laying out various types of hot water hook-ups:

Fig. 1 shows how to pipe up a hot water storage tank, a hot water temperature regulator and a steam control valve. The regulator is hydraulically operated. Simply connect to service water system at the point marked "⅜ in. water pressure supply to regulator." When the temperature of the water reaches the desired point, the metallic expansion tube, which is inserted into the tank, expands and permits the water pressure to pass through the regulator to the diaphragm valve and shuts off the steam. When the temperature decreases the tube will contract, thereby discharging the pressure from the diaphragm valve and turning on the steam.

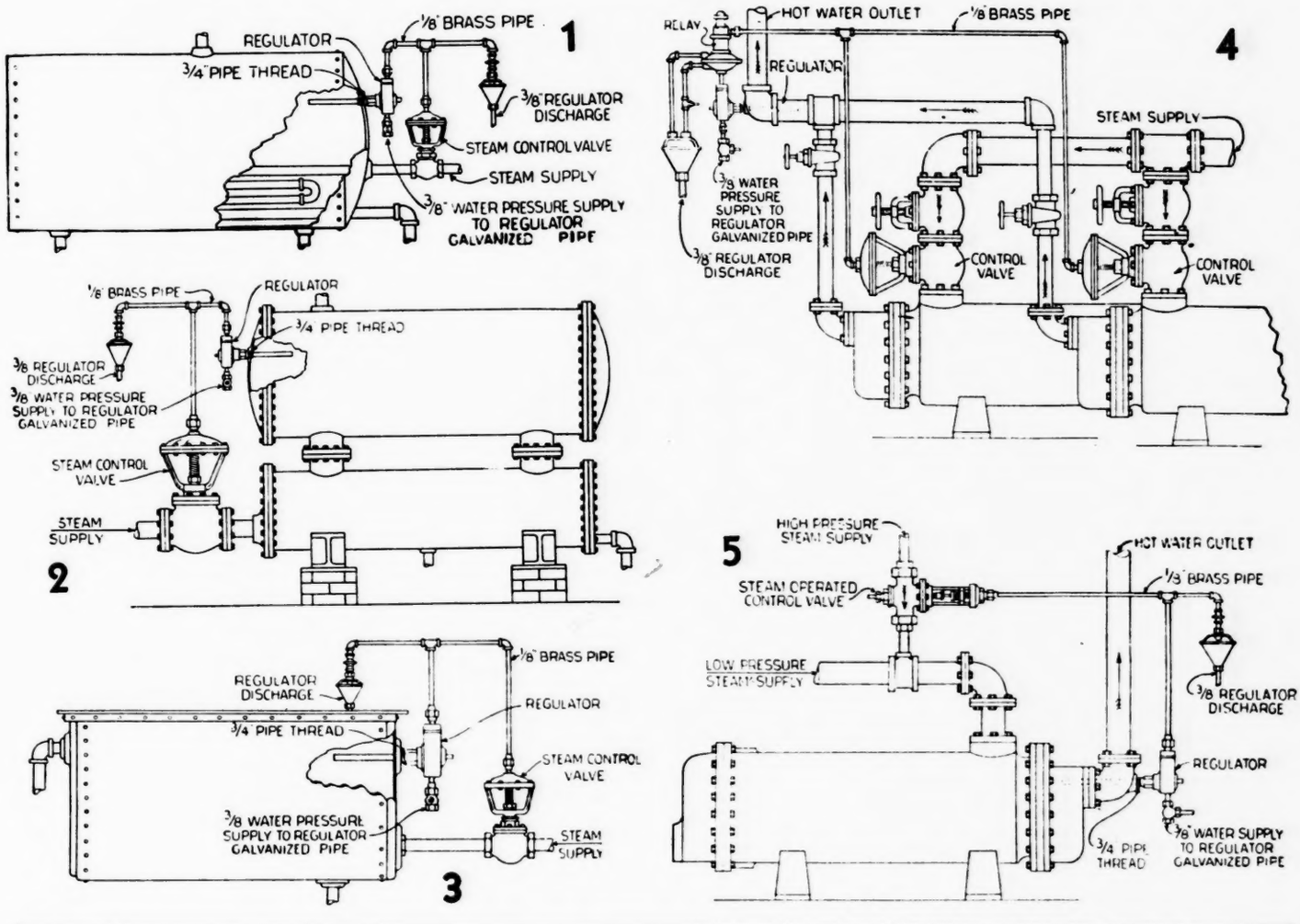
A regulator of this type will operate the largest steam or other control valve, at any pressure, with as little as two degrees variation in temperature. It is easily adjusted to act at any temperature up to 300F.

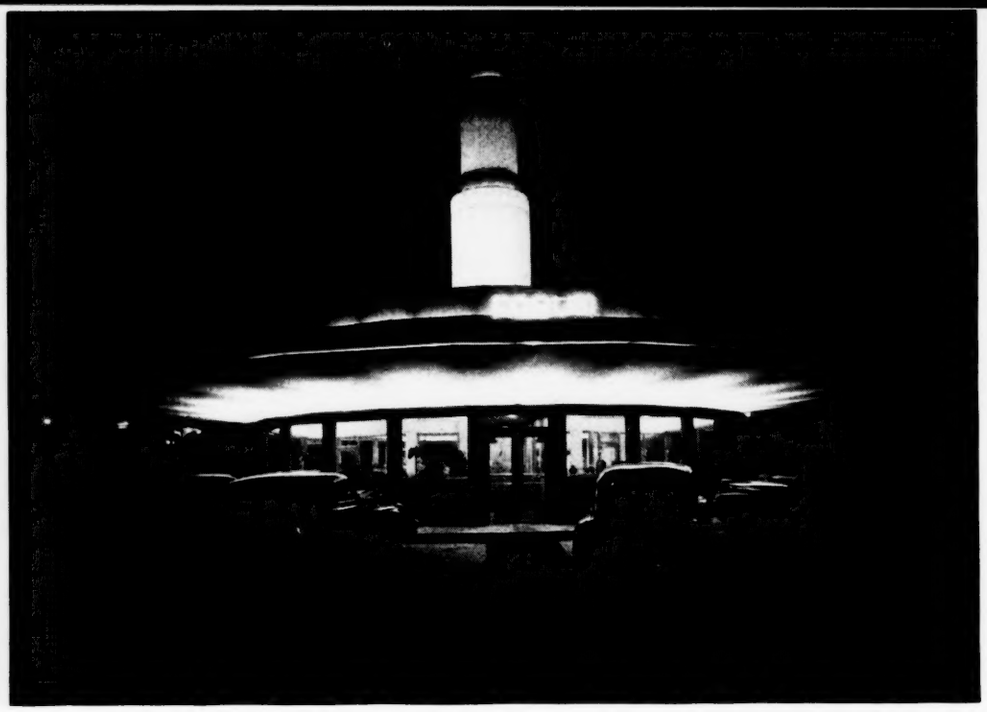
Fig. 2 shows how to pipe a hot water heater and storage tank. The operation of the regulator is precisely the same as in Fig. 1.

In Fig. 3 is shown how to pipe an open tank. It will be observed that the piping arrangement for Figs. 1, 2, and 3 is very much the same in each instance.

Next is a slightly more complex problem, Fig. 4, which shows how to pipe two hot water generators, both control valves being operated by one hot water regulator. An extension of this method will take care of any number of control valves.

Finally, Fig. 5 shows how to pipe a hot water generator using high pressure supplementary steam for doing the heating. It is assumed here that the low pressure steam supply need not be regulated at all because it is insufficient in quantity. Some high pressure steam must therefore be automatically added from time to time.—*W. F. Schaphorst.*





The new Forum Drive-In restaurant in Kansas City. An unusual touch is added by the illuminated tower, visible for several miles.

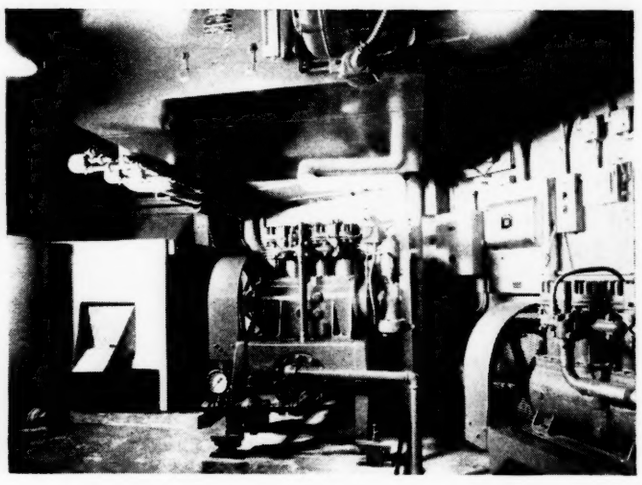
# Kitchen Air Conditioning Features Kansas City Drive-In Restaurant

WHEN the Forum, Incorporated, nationally-known chain of popular priced cafeterias operating in half-a-dozen cities elected to test application of drive-in methods to cafeteria production with a handsome new drive-in restaurant in Kansas City, Missouri, one of the primary specifications was that both dining room and the kitchens be comfortably air-conditioned.

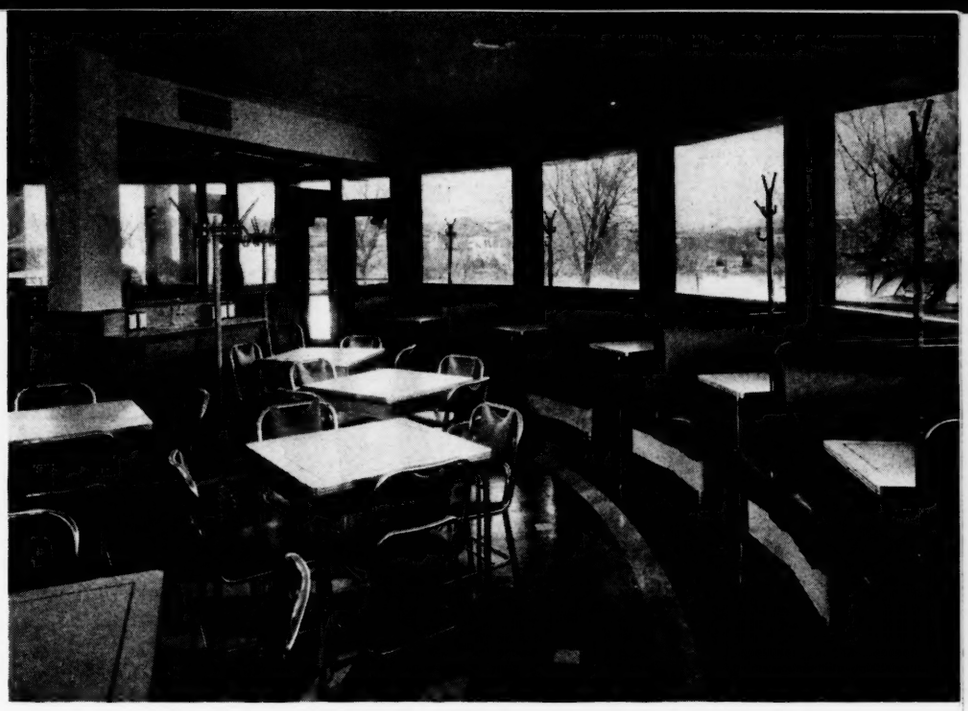
The new Forum Drive-in Restaurant is located on Kansas City's Country Club Plaza where heaviest traffic in the city passes and is arranged to serve approximately 70 persons in a large dining room and 250 in the privacy of their automobiles on a hard-surfaced parking lot outside. The building is in the shape of a 20-sided polygon, with plate glass windows all around through which most of its operations can be viewed, and has a high illuminated tower similar to an air craft beacon which indicates the restaurant's position for miles either way. The semicircular kitchen extends around the rear and is slightly larger than the dining room, which is to be used by families or customers who prefer dining at a table rather than from trays in their automobiles parked outside. The main kitchen food station is so situated that orders can be handed out at one side to car-hop parking lot service girls, or through a small window into the dining room with equal ease.

The air conditioning specified was unusual for several reasons. First, the air conditioned kitchen possibly is the only such in a commercial restaurant anywhere in the country, and was installed for the dual purpose of production efficiency and making the working lives of employes more pleasant at a time when kitchen personnel is difficult to obtain. In Kansas City's often 100-degree-or-higher summer temperatures, it was felt that keeping the kitchen at a comfortable 80 degrees would keep all employes content with their jobs. Second, because of the small size of the building, the air conditioning equipment had to be installed in an absolute minimum amount of space, requiring considerable ingenuity on the part of Temperature Engineering Company, Carrier dealers in Kansas City who designed and installed the twin conditioning systems. One of these systems is for the kitchen while the other takes care of the dining room.

The kitchen installation is of 20-ton capacity, gen-



Equipment room, in the tower attic, which houses the dining room air conditioning apparatus.



**Dining room showing, at the upper left, two of the grilled openings for supply air.**

erously sized to allow for the heavy heat load arising from steam tables, bain maries, gas ranges, steam kettles and hot plates used. The preparation section of the kitchen is in a circular basement, where enough space was left to install the 20-ton compressor and an evaporative condenser cooled by city water. The refrigeration equipment is located directly beneath the plenum chamber containing the direct expansion coils and blower, and a fresh air intake opens from the basement window directly into the chamber. Altogether a floor space of only about 6 x 6 ft is required for all equipment. This system, thermostatically controlled from a point in the center of the ceiling, delivers 15,000 cfm of air cooled to 75F, and keeps the kitchen at an even 80F despite the heavy load. Air is distributed by means of Venturi-Flo diffusers in the ceiling, located directly over the major heat producing zones, which mushroom cooled air smoothly over the room. Part of the heat load is handled by a 6000 cfm exhaust fan in the ceiling air space, which prevents an accumulation of overheated air. The kitchen system is also notable for the fact that it circulates 100% fresh air, brought in from the basement window intake, and exhausted immediately after passing once through the room. By this means stale food odors are effectively removed.

**Preparation section of the kitchen in the basement, with its refrigeration equipment shown at the left.**

The dining room cooling system is a 15-ton installation, with all equipment located in the tower attic. Here a 15-hp compressor and a small evaporative condenser projecting at the rear of the tower are housed vertically above the plenum chamber, which contains a 10,000 cfm blower, although only 8000 cfm normally are required to cool the room to 80F. An attic fan exhausts heated air rising from the compressor. Cooled air is delivered into the large dining room by three large simple grilles spaced along the upper walls, sufficient to cool the smaller, less-active area represented. The thermostat controlling this area is located in the return duct, and about 80% of the dining room air is recirculated. Vestibule type doors opening into both the kitchen and dining room aid in maintaining temperature at low expense, although the kitchen cooling system operates almost continuously.

Additional refrigeration equipment used in this Forum Drive-In include a 2 hp condensing unit refrigerator for sea foods and perishable foods, a 1 hp drinking-water cooler, a ¾ hp root beer tap system, and an 8-hole ice cream cabinet powered by a ½ hp compressor. In the basement are three large walk-in refrigerators connected to a 2 hp unit. A smaller box is used for chilling salads and desserts next to the steam table.

An outstanding feature of the installation is that all controls for conditioning and refrigeration are grouped on a single panel board in the kitchen, which has complete hand valves for each unit for shutting down independently where necessary. The refrigerating compressors were installed to save space in banks of two in the basement, directly over each other in a ladder-like arrangement. This kept all equipment quickly available for service, and yet releases every possible inch for food preparation and storage.

# HOW TO MEET WAR TIME RESTRICTIONS

## BY T. W. REYNOLDS

**EDITOR'S NOTE: The demand for critical materials is so heavy that special study as to the essentiality of all items of construction is necessary. With this in mind the information which follows has been prepared as a continuation of similar material presented as Reference Section No. 9 in the February issue, and an article "How to Meet War Time Restrictions in Heating and Air Conditioning Design," which appeared in the March issue of HEATING AND VENTILATING.**

### Chemical Dehumidification

Chemical dehumidification is in particular adaptable to the maintenance of very low humidities, such as in drying jobs, airplane plants for plywood planes, dope rooms and similar operations. Its availability for small as well as large installations avoids the necessity of removing existing refrigeration machines, except for straight cooling processes, such as for synthetic rubber and gasoline. Where lithium chloride is used, it can be circulated by a pump because it is a liquid, so that the entire cycle is made continuous without duplication of equipment. The estimated savings in metal by the use of this method compared to refrigeration by compressors (especially so with the larger sizes of lithium chloride equipment where glass plates are substituted for steel in the contactor), is for three typical process cases, small, medium, and large (designated as Nos. 1, 2, and 3), 1250, 14,000, and 50,000 lb. Stated in other words, the metal weights for lithium chloride equipment in the cases cited are 5,000, 19,000, and 50,000 lb., whereas for refrigeration the metal weights would be about 25, 75, and 100% greater in amount. Weights do not include supply air fans, sheet metal air chambers, piping, etc. Data on which the estimates were based are as follows, and the weights will vary somewhat according to the engineer and his particular selection of the units involved.

Case 1—5,000 cfm at 95F DB 78F WB (120 grains to 40 grains) to 96F DB 64½F WB.

Case 2—24,000 cfm at 90F DB and 133 grains to 103F DB and 39 grains.

Case 3 — 100,000 cfm at 95F DB 78F WB to 96F DB and 40 grains.

NOTE: Water at 80F. For lithium chloride, total motor brake horsepower 2, 13, and 76. For refrigeration, tonnages of 48, 237, and 960, with motor horsepower of 50, 250, and 1,000 and delivered air at 42F saturated with reheat to the dry bulb temperatures given in the respective cases. For lithium chloride, steel has been replaced with glass plates in Cases Nos. 2 and 3 with weight of glass plates of 2000 and 31,200 lb. For refrigeration, Case No. 1 with compressor, condenser and either a washer or coils, Case No. 2 with compressor and either a condenser or evaporative cooler, and motor or steam turbine drive, together with a washer or cooling coil. Case No. 3 with motor or steam turbine drive, compressors, condensers, and water coolers, together with a washer, and also a complete chilled water pumping system with 100 hp motor and insulated piping for circulating the chilled water.

The point may well be made that in many a process case, partial or full reheat may be obtained from the process itself, in which case there is no charge against operating costs for reheat, or for the weight of a reheat coil; however, deducting the weight of reheat coil which is 390, 1750, and 4300 lb, respectively, will have but negligible effect on the results, which apparently are about as estimated for 80F water, or a saving in critical materials for lithium chloride systems of about 25 lb per ton of refrigerating effect for the very small jobs and 50 lb per ton for larger jobs.

In the case of lithium chloride the latent heat liberated by the condensation of the water vapor is of course converted into sensible heat, but this sensible heat is carried off by the lithium chloride solution itself and is transferred through the solution cooler to the cooling water medium. For this reason the air leaving the lithium chloride system is usually at a lower temperature than the air entering the system and as a consequence, refrigeration which is accomplished by removal of all latent heat, is in most cases supplemented by removal of a part of the sensible heat as well, so that generally no further treatment of the air is necessary after it leaves the dehumidifiers. In other types of chemical dehumidifiers the sensible heat is carried away entirely by the air with resultant high temperature requiring as a rule further cooling and therefore no refrigeration is saved except as this sensible heat is easier to remove. In such cases the dry bulb temperature of the leaving air will depend entirely upon the temperature of water available for cooling the warm air.

An actual installation of a lithium chloride system as recently made will best serve to illustrate the comments as contained in the preceding paragraph. In this installation the requirements were for dehumidification of 5000 cfm of air from 95F DB 78F WB to 80F DB at 20 grains per lb with 60F water to precool the air 90 grains per lb.

One way of accomplishing these results would be for refrigeration in the form of direct expansion to lower the temperature and further dehumidify to approximately 62F saturated, after which 5600 cfm of air could be blown through two silica gel units (with leaving temperature of 125F at 20 grains per lb) and an after cooling coil for cooling the 125F air to 80F. Note that in this case an increased quantity of air is required at the beginning of the cycle to compensate for a loss of about 10% while blowing through the units.

With the lithium chloride system the requirements could be met by using the precooling coil as before and with only 5000 cfm of air, after which the cycle would produce the required leaving air temperature without any refrigeration or after cooling and with a saving of several thousand dollars as well as a saving of a lot of critical materials such as would be required by refrigeration.

### Reheat In Air Conditioning

Reheat should be kept as small as possible, as it increases the required capacity of a refrigerating plant, except in the case of the run-around cycle. The use of the latter method conserves critical materials and gives an operating cost that is small in comparison with any other method of obtaining reheat, though where the amount of reheat is but a small percentage of the total refrigerating effect, warm condenser water may be preferred for reheating. In the run-around cycle sensible heat withdrawn from the warm air by the pre-cooling coils is circulated by water to the reheat coils where it is added to the flowing air. Reheat as obtained by steam requires piping

# IN HEATING AND AIR CONDITIONING DESIGN

and also requires additional fuel and boiler capacity, except where excess exhaust steam is available.

Reheat may sometimes be obtained from the process, by omitting insulation from the roof of the conditioned structure, or by the use of windows where they might otherwise not have been used. Windows, of course, increase the winter heating load, but if not installed in the structure there will be required approximately the same amount of critical materials for necessary ventilation equipment.

## Roof Sprays

Spraying the roof of air conditioned spaces is in general not warranted in view of the tremendous quantity of water, piping and sprays required just to conserve what is usually but a small portion of the total cooling load. Where a sufficient quantity of water may be cheaply obtained, for example; well water previously passed through cooling coils and not required for process or warm water discharged from condensers, it may be that the use of roof sprays would be justified when connected with only second-hand pipe and when further balanced against the amount of roof insulation otherwise required. Still other examples of such justification might be where numerous unit air conditioners are installed just below the roof, in which case spray systems could be extended from and connected through short branches to the water piping required at each conditioner, or where numerous short connections could be made to process water piping continuously routed throughout the building, providing of course that the increased usage of water for roof sprays would not effect any appreciable increase in size of large process distributing mains.

## Motors and Wiring

Motors, when 1 hp or over, should be specified of a type which makes probable their availability in the second-hand market. New electric motors, other than open type, may be permitted in hazardous locations as defined by code, or when integral with or specially designed for driving individual machines and for which there is no substitute. Motors should not be multi-speed where other methods can be used for obtaining the various speeds required. Motors of the higher standard speeds are built with less critical materials, and motors of 440 volts use less copper in the leads and controls than those for 220 volts.

Overloading of motors will save as much metal as 40% with overloads of 25 and 15%, respectively, for alternating current and direct current motors (except when the temperature of the surrounding space is unusually high), and 10% for enclosed motors. Pre-war motors can be overloaded to a greater extent than those now being made. Where possible, the engineer should combine the capacity of two motors into one larger motor. For example, one large fan may be used instead of two small units, except where the greater size of the single large unit makes the fan or motor unavailable on the market. Standard sleeve-bearing motors should be used rather than ball bearing motors. Controls and circuit protective equipment should not exceed the horsepower rating on the nameplate.

Electrical wiring systems should be designed for minimum amounts of copper, rubber, and steel without provision for future extensions. Conductor sizes shall be the minimum sizes permitted by the 1940 electrical code as amended for the duration.

Where wiring is exposed to injury or where it is imperative to imbed wiring in the masonry or concrete of a structure, wiring may be run in zinc or non-metallic coated electrical metallic tubing (ferrous metal thin wall) 2 in. or less in size, and non-metallic coated ferrous metal rigid conduit for sizes over 2 in. Where exposed to severe mechanical injury or in a hazardous location where the code requires dust-tight or explosion-proof fittings, wiring may be run in zinc or non-metallic coated ferrous metal rigid conduit. All other wiring shall be open wiring or insulators or non-metallic sheathed cable, or concealed knob and tube work with non-metallic boxes. Rubber insulation may be permitted on building wire (not including solidly grounded conductors) in wet or hazardous locations.

## Controls

Controls for heating systems have been an orphan in the war picture. Conversion from oil to coal has occupied our entire attention though now is being diverted to conservation apart from conversion for the following reasons:

(1) Conversion from oil has a definite end which may be substantially reached yet this year; (2) some percentage of the oil burning plants, usually the larger ones, can not or should not be forced to convert; (3) plants still allowed oil should have control equipment so that oil may be conserved and maximum results may be obtained from the oil rationed and public health and war production insured; (4) coal demand of converted plants may soon exceed the supply and there may be lack of transportation and manpower in the mines next year; (5) conservation should include not alone fuel saving, but also saving in labor and equipment for producing, transporting and handling of fuel, also consideration as to the number of cars or boats empty on return trips or released for other service and reduction in trucking from depot to consumer: (6) conversion takes much of critical materials, the time of planners and workers, and often involves delay to war production which, when restricted, requires additional boilers of critical steel plate needed for boats.

Only one ton of critical materials may be required to save 1000 tons of coal or 4000 barrels of oil annually. For example: control systems known as sub-atmospheric steam or high vacuum in a number of installations mainly supplied with street steam, therefore metered and accurate, gave a saving of 7167 tons of coal or 30,003 barrels of oil per year with weight (in lb) of critical materials for controls of 3211 of copper and brass, 11,669 of carbon steel and 94 of aluminum. This record covered 16 properties or 42 buildings (1 to 19 stories) with a total floor area of 3,183,271 sq ft, and 497,231 sq ft of radiation. Of these buildings, 6 are offices, 23 manufacturing, 2 printing plants, 3 dormitories, 5 hospitals, one school and one loft. The National Association of Building Owners and Managers likewise reports that in 334 office buildings savings due to high vacuum controls were over 30%.

In order to stimulate the use of suitable controls the following procedure should become the order of the day. (1) Plants where conversion is unduly difficult and expensive should continue with oil provided controls are installed for economical heating and use of fuel; (2) coal users should install controls to avoid rationing next winter and ease the load on manpower, mining, and railroads; (3) oil rationing should weigh the existence of controls, for an owner who spends money for controls should not be rationed as severely as one who has no adequate control.

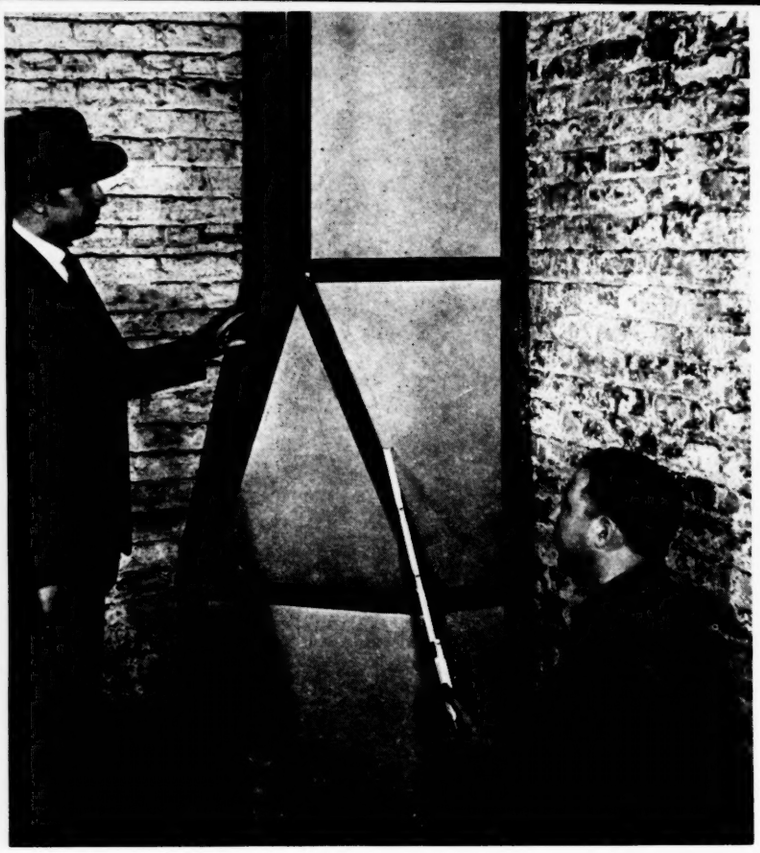


*Fig. 1. An installation of sheet board duct. According to T. M. Cunningham, construction manager of Carrier Corporation, a recent duct system installation estimated at 300,000 lb required only 66,000 lb of sheet metal, sheet board being substituted for the remaining 234,000 lb.*

# NON-METAL DUCTS—

## *Are they here to stay?*

SUBSTITUTE materials in place of the critical metals once used almost exclusively for ductwork in heating, ventilating and air conditioning systems are coming more and more into their own as a result of the war conditions. These materials are experiencing a process of trial by fire, so to speak, and much information as well as many disputed questions about the relative advantages or disadvantages involved in their use are being steadily, although perhaps slowly, evolved and settled.

The general feeling of those who necessarily are closest to the picture, because of being engaged in manufacturing, installing or using the replacement materials, seems to be that constant progress is being made toward finding the all-satisfying substitute and that chances of this eventually happening are rather good, although nothing spectacular has occurred, or is likely to occur, to revolutionize the situation overnight. No one knows the extent to which sheet metals have been, or will be, permanently superseded by their substitutes, but it is an interesting and important question to those directly concerned and to others in associated lines, and the situation has reached the stage of minor debate as to just what the final effects will be.

Some of the factors having a bearing on the picture, and some of the better-known products together with their properties and the problems encountered in their use, are here considered.

Representative comment exemplifying the viewpoint of the large manufacturer and installer of air conditioning systems is that of the Carrier Corporation, which has had considerable experience with the new materials.

### Desirable Qualities

This company feels that substitutes for sheet metal should have a hard smooth finish, and be non-hygroscopic, non-warping and non-inflammable. If possible, the material should be workable with tools usually used for sheet metal work so that the construction of the sheet board ducts will not involve a retooling program. Availability should be considered, also the ease of fabrication, strength and durability of finished duct or casing, rigidity of material, and surface resistance to air flow.

Many of the products on the market meet these requirements, and among them may be mentioned Asbestos Ductboard, Asbestocite, ARA Board, Transite, Formdux, Sal-Mo, Masonite, Hardboard, Pitch-On-Metal, Careyduct, Asphalt Mastic Board, and others. Advantages over metal are that they are more rigid and so do not require the cross-breaking that is used in metal ducts, and they have

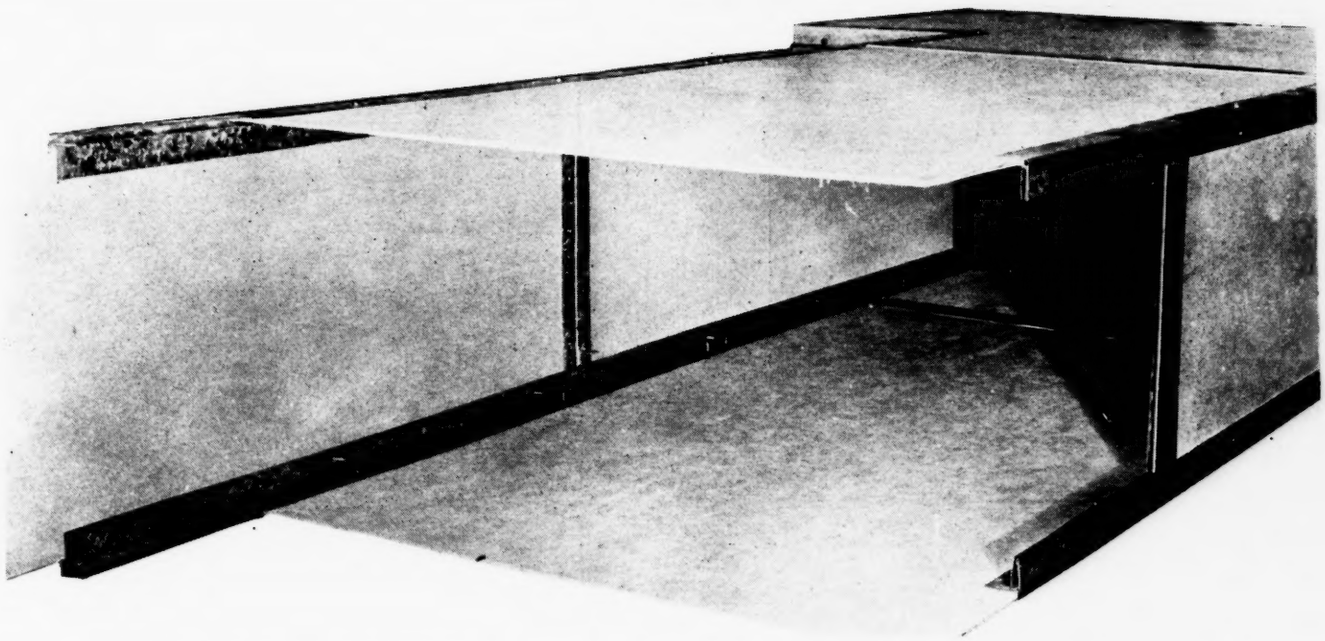


*Fig. 2. Method of construction of non-metallic duct, showing the sheet metal slip joint.*

higher insulating value so that the Btu loss or gain is less than in sheet metal ducts.

### Board Thickness

Sheet board 3/16 in. thick may be used throughout for some air conditioning systems, especially those ranging in size from 10,000 to 50,000 cfm, in the open. By using only one thickness for an entire duct system, fabrication costs are reduced and tooling problems simplified, resulting in lower installation costs. In systems larger than 50,000 cfm, it is advisable to use ¼ in. board to eliminate stiffening and other construction extras.

Since substitutes usually are not so smooth as sheet metal, flow resistance is greater, but ordinarily not sufficiently so as to require larger ducts. As square vaned elbows, and many other fittings may be made in sheet board ducts, the layout of the air conditioning system need not differ materially from that which has long been the practice in the industry.

### Supports

Sheet board ducts are supported in about the same general way as sheet metal ducts except that supports normally are heavier since non-metal ducts usually weigh more than the metal.

The use of sheet board ducts will probably continue after the metal shortage no longer exists, since this type of material is a proved substitute, in the opinion of the Carrier Corporation.

A recent duct system installation estimated at 300,000 lb required only 66,000 lb of sheet metal. Sheet boards were substituted for the remaining 234,000 lb. Even greater metal savings are possible, depending on the installation.

### Comparative Costs

A somewhat different view is expressed by Louis L. Narowetz, Jr., of Narowetz Heating and Ventilating Co., Chicago, who believes that sheet metal

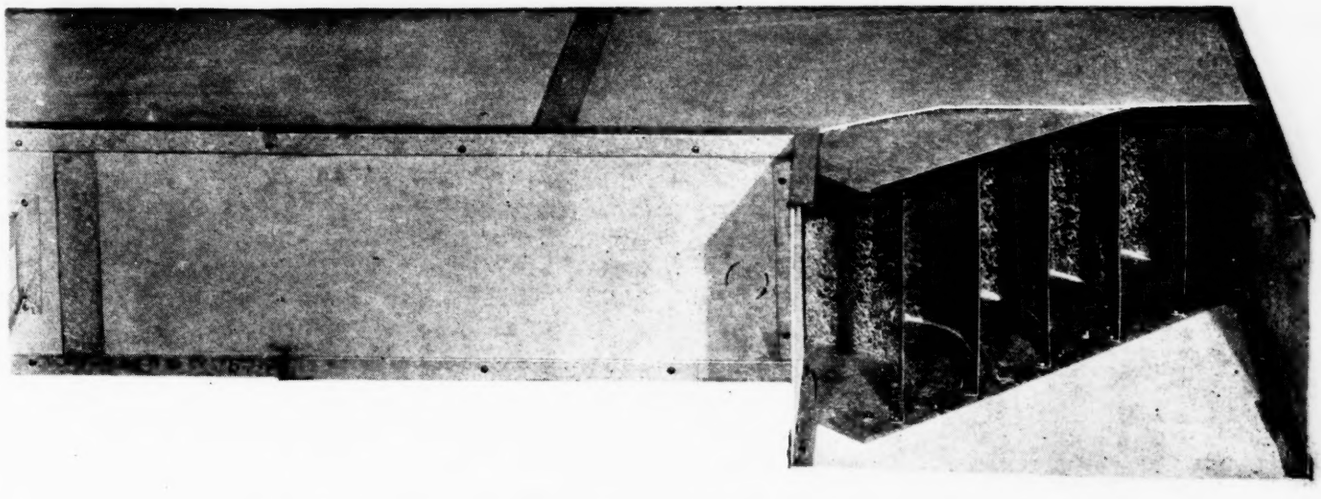
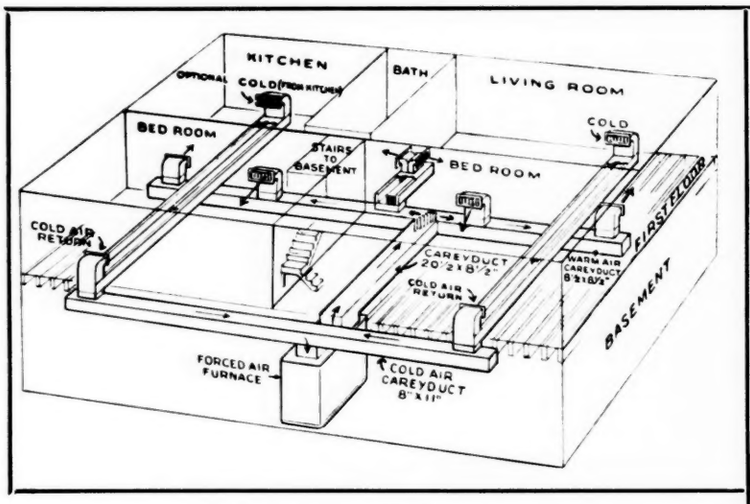


*Fig. 3. A square elbow with turn-vanes in a duct made of board type material.*



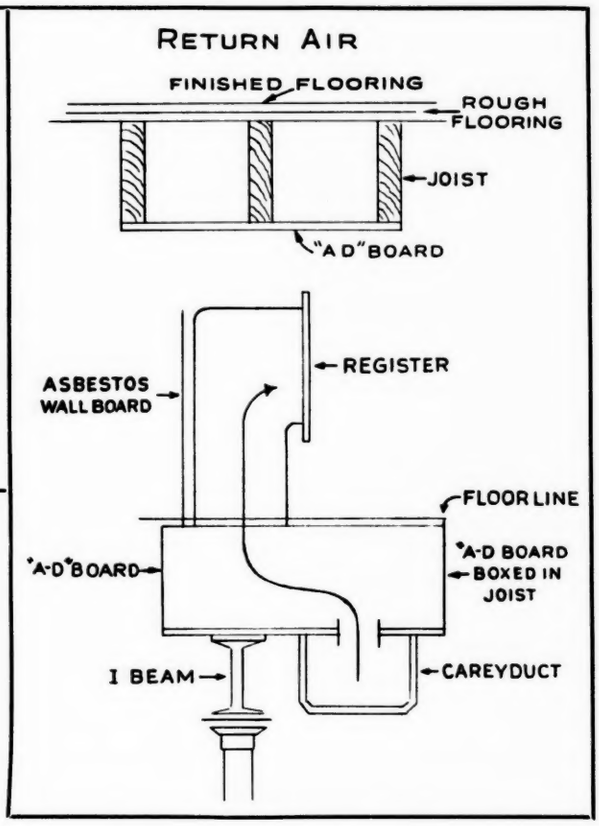




*Fig. 4. (Above) and Fig. 5 (Right) Typical war housing installation showing application of asbestos board duct materials as used in a warm air heating system.*

will return after the war to its former leading position, basing this opinion on his own experiences with various substitutes. He finds that actual cost of substitute material is more than that of galvanized iron because of the limited sizes of sheets available and because of increased waste and breakage, the latter two adding up to a figure possibly double that encountered in fabricating metal ducts. The labor involved in fabrication is slightly more than for metal, but for transporting from the shop to point of erection, and for the erection itself, more men per section are required due to the greater weight and the danger of breakage in handling. Ducts smaller than 18 in. in any dimension are apt to cost twice as much as metal, and larger ducts 50% more. Where asbestos cement sheets are used as a lining to form chambers or tunnels the relative cost is much the same. Also, custom and usage have developed men skilled in the art of fabrication and erection of sheet metal, and adapting them to the use of substitutes naturally is more costly, particularly in the initial stages of working a new material.

## Workability

Another strong point in favor of sheet metal, according to Mr. Narowetz, is the greater ease of making transitions from one shape or size to another, or to take care of the many instances where unforeseen interferences are encountered in the field and ducts must be changed to meet the conditions. The ductility and adaptability of sheet metal are hard to match in this respect.

## Casings

However, he considers abestos fibre sheets very advantageous for use in apparatus casings, especially where insulating requirements must be met. Built-up laminated corrugated thicknesses of ½ in. to 2 in., depending on the coefficient of insulation desired, protected by 3/16 in. outer slabs, gives a rugged construction when properly fitted in place and insures permanence as well as compliance with fire ordinances. Ordinary drills and saws are used in the assembly, metal joining strips or angles being used with cements especially prepared by the manufacturer, which are used to butter the edges of sheets while erecting. These act as a seal so that the casing becomes practically air tight. This finished casing is durable, neat in appearance and takes a good paint job. It also compares favorably in cost with insulated metal casings. Sheet metal workers adapt their skill fairly easily to this type of application and the work is within their labor jurisdiction.

## War Housing Applications

Figs. 1 and 2 show a typical war housing installation in which asbestos board duct materials are used in the heating system. This four-room house consists of living room, two bedrooms, bath and kitchen, all on one floor. The main 20½ x 8½ in. all asbestos duct from the furnace forms a T-joint with the 8½ x 8½ in. warm air asbestos plenum which parallels the I-beam. Warm air is distributed from this line through the boxed-in joists. These boxes are formed by nailing A-D Board across the joists. This is a laminated board, faced with white asbestos on both sides, possessing good sound deadening qualities and being electrically non-conducting. No finish is required although it can readily be painted. This board is 33 in. wide for standard

joist spacing of 16 in. It is approximately ⅛ in. in thickness, light in weight, yet surprisingly rigid.

This same board is also used to box in the joists that serve as return air ducts running from the outside walls of each room into the 8 x 11 in. cold air trunk line. The return from the kitchen is optional.

Masonite, a smooth, hard, highly-compressed wood sheet made by Masonite Corporation, Chicago, is another type of substitute duct material. It has a moisture absorption of 7.5% in 24 hours and is rated by the National Board of Fire Underwriters as slow-burning material. It usually is used in 3/16 in. thicknesses, fastened together with metal connectors and slotted corner angles. Installation practice is much the same as with the hard asbestos-cement type of products, except that in most cases fewer sheet metal screws are required. The material is cut conveniently with a hand or portable electric saw, and can be sheared.

### Bureau of Standards Tests

A recent study of sheet metal substitutes made by the Bureau of Standards, inspired by a very real interest of the Government in the matter, is worthy of note. It dealt mainly with the fire retardant properties of various materials, but the report also touched upon the point probably uppermost in the minds of manufacturers, contractors, sheet metal workers, and others thinking about the after-the-war outlook for substitutes, namely the evolving of a workable and practicable installation technique. It notes that unfortunately, no readily available material has the same characteristics as metal from the viewpoint of the sheet metal worker, and that a substitute which could be worked with the same tools and technique as metal would find a much more enthusiastic acceptance by the trade, because any changes required in the procedure of fabrication and erection usually will work a hardship by slowing up the job, consequently increasing the costs.

Regarding resistance to fire, the report notes that since fire safety requirements are lower for returns than for the hot-air ducts, different materials for the two kinds of ducts are used in many installations.

Among the pliable boards tested were several composed of a felt base with high melting point asphalt saturant and coating. Others were of similar composition for the core with facings of asbestos paper. These are combustible. Other pliable boards have paper boxboard or pressboard cores with asbestos paper facings. Some of these are rated *combustible* or *slow-burning* and others *fire retardant*. The incorporation of bituminous materials to lower absorption will usually increase flammability.

Cement asbestos boards have many characteristics that make them suitable for duct walls, although they are not readily worked into turns, branches, and other complicated fittings. In one system of fabrication, the edges of the board are mitered and cemented together with an adhesive, after which paper is applied to bind the corners on the outside. Another system employs grooved strips of flameproofed wood for corner members, and a third employs metal corner strips. All of these require some metal for fittings and unusual conditions.

A substitute for galvanized metal suitable for ducts or duct fittings recently placed on the market consists of pickled iron sheets coated with a high melting point compound of fatty acid pitch containing a high percentage of inert mineral filler.

This coating is covered with mica dust, which gives the sheet a gray color and a greasy feel. The technique and tools for working this material are the same as for galvanized metal except that preparation for soldering requires the removal of the coating from the areas to be joined. It is probable that this material will be acceptable to sheet metal workers for use in lieu of the galvanized steel usually employed. The tests have indicated that only materials classed as *incombustible* or *fire retardant* should be used for hot air supply ducts, with those of the latter classification at not less than 6 ft. from the heating plant if liquid or solid fuels are employed. Material for return ducts may be of lower classification with respect to fire safety, but combustible materials should not be used within 3 ft. of the heating plants, according to the Bureau's recommendations.

## Dry Ice Kills Coal Pile Fires

A new and ingenious use for dry ice as an extinguisher of coal pile fires has been developed recently. An estimated 80,000,000 tons of bituminous coal is now in storage throughout the country, a figure double the usual season's reserve. This likewise doubles the risk of loss through spontaneous combustion, notwithstanding the protective effect of modern methods of storage. The dry ice is applied directly at the seat of the fire, through 15 ft. 3 in. driven pipes fitted with perforated tips. Charges of 50 lb of the solidified $CO_2$ are placed in the pipes. Heat liberates the gas to blanket the hot zone and smother the smoldering coal, while the chilling action of the dry ice reduces the local temperature, thus effectively eliminating the hot spot.

To locate such danger points in the pile a hot-spot indicator, consisting of an iron pipe containing a spring-loaded signal, held back by a chain with fusible links at one-foot intervals, has been made available by the same manufacturer. Only the hottest link lets go, permitting the signal to rise, and this occurs only when temperature rises to 150F. Thus the location and depth of the danger point are advertised 72 hr before combustion can take place, at the normal rate of temperature rise for the average coal composition.

# WASHINGTON NEWS

## *Summarized by Loring F. Overman. Comfort Cooling Repairs Restricted; New A. C. Equipment Earmarked; Civilian Supply to Get Recognition.*

Washington highlight for March, from the standpoint of air conditioning and refrigeration industries, was the issuance on March 27 of amended WPB General Limitation Order L-38 and Limitation Order L-126.

Effective April 6, Order L-38 establishes stricter controls over the production and delivery of refrigerating and air conditioning machinery, water coolers, and all related equipment except domestic refrigerators and farm milk coolers.

Amended L-126, also effective April 6, sets up a mandatory standardization and simplification program by issuing six schedules of required specifications applicable to the types of equipment authorized by L-38.

### L-38 Restrictions Drastic

The restrictions on deliveries and production covered by the Order involve all phases of the industry, including dealers and distributors. A knowledge of the contents of the order is obviously mandatory for engineers, architects and contractors.

Besides covering all refrigerating and air conditioning machinery except farm milk coolers and domestic refrigerators, L-38 also covers industrial type extended surface heating equipment, such as a reheat or tempering coil or a combination heating and cooling coil where the coil is used in connection with an industrial or commercial conditioning system.

The order restricts the delivery of any new or used parts for emergency repair service unless: (1) For use in "emergency repair service" and to fill an order bearing a rating of AA-4 or higher; (2) to fill an "authorized order", as defined in the Order; and (3) for direct use by the Services.

All replaced parts made of metal must be delivered by the owner to the dealer or producer, if required, or disposed of to a scrap dealer within 30 days, except parts delivered outside the continental U. S., used directly by the Armed Services, or for use by Federal, State, or local governments prohibited by law from disposing of such parts.

### Comfort Cooling Restricted

No new or used parts may be delivered for the repair of a comfort cooling system except under one of the following conditions:

1. To fill an order bearing a preference rating of AA-4 or higher providing the sales value of the part or parts does not exceed $25 for systems 20 hp or less, $50 for systems 20 to 100 hp and $100 for systems over 100 hp. The owner or user of a comfort cooling system may apply to his local WPB office for such a preference rating.
2. To fill an **authorized order** if the value of the part or parts is more than stated above. No such order will be authorized unless it is demonstrated to the satisfaction of the Director General for Operations that the continued operation of such comfort cooling system is essential to avoid air conditions which would be actually intolerable or dangerous.

Appended to the Order is List F, which includes the following as subject to the limitation:

Amusement parks; animal hospitals; auditoriums; ballrooms, dancing studios and dance halls; banks, and loan associations; bars, cocktail lounges and beer parlors; bowling alleys; concert halls; funeral parlors; golf clubs, country clubs, and athletic clubs; hotels and apartment houses; moving picture theaters; night clubs; office buildings and offices, public or private; railway, street car and bus stations, and terminals; residential buildings and dwellings of all kinds; restaurants, cafeterias and other places selling meats, foods or beverages; schools; service establishments, such as laundries, cleaners and dyers, tailor shops, barber shops, beauty parlors, automobile sales and service shops, and repair shops of all kinds; skating rinks; stores selling any kind of products, material or merchandise, at retail, or wholesale (excluding manufacturing establishments); and theaters.

In publishing the foregoing list the Order explains the term "comfort cooling system" shall not include:

(1) Any such system used to air condition a building, room or other enclosure used chiefly for purposes not listed above, or

(2) Any system designed, necessary and used, in substantial part for the refrigeration and storage or processing of food, ice (except in skating rinks), or other materials or products requiring refrigeration, temperature control, or freedom from dust or other impurities, or

(3) Such part of a system as may be necessary and used for the circulation of air, and used for raising the temperature of air during cold weather to a degree which is comfortable or tolerable for persons (comfort heating).

### New Equipment Earmarked

In addition to limitations placed upon production and delivery of repair parts, Order L-38 earmarks all new equipment. The delivery of any new refrigerating or air conditioning system of any size or any used high side, compressor, turbo blower, condensers, low side, or evaporator designed for use with a system rated at 3 hp (or tons) or larger, or any new industrial type surface heating equipment, or any new industrial type humidifying equipment, shall be made only to a person acquiring same for use pursuant to an authorized order (WPB-approved), or for direct use by the Army, Navy, Maritime Commission, or War Shipping Administration.

Equipment delivered for the direct use by these agencies does not include equipment purchased by contractors for the use of such agencies nor does it include equipment purchased by a defense plant operated for the exclusive use of these agencies. This is exclusive of the systems or items on List A of the Order, or List B, or farm milk coolers.

### L-126 Simplifies and Standardizes

In issuing Limitation Order L-126, WPB explains, "The fulfillment of requirements for the defense of the United States has created a shortage in the supply of iron, steel, copper, brass, bronze and other critical materials for defense, for private account and for export; and the following order is deemed necessary and appropriate in the public interest and to promote national defense."

The order then states that WPB may from time to time issue schedules establishing required specifications (for industrial and commercial refrigeration and air conditioning machinery and equipment). Upon and after the issuance of any such schedule, "no person shall manufacture, assemble, sell, deliver or in-

stall any new system or new parts except in accordance with the terms of such schedule, and no person shall purchase, receive, install or use any new system or new parts which he knows or has reason to believe were not manufactured in accordance with the terms of the schedule."

Based upon Order L-126, which serves as an enabling act, WPB's Air Conditioning and Refrigeration Section has issued six schedules, effective April 6, covering types of equipment production of which is authorized, under certain conditions, in Order L-38. Following are provisions of the schedules:

SCHEDULE 1—Self-Contained Drinking Water Coolers.

1. Permits 3 sizes of marine type coolers for use aboard ship.
   No other sizes or types permitted.
   5 gph—1 bubbler, 1 glass filler
   10 gph—2 bubbler, 1 glass filler
   20 gph—2 bubbler, 1 glass filler
2. Limits amount of copper per size as:
   5 gph—11 lb
   10 gph—15 lb
   20 gph—20 lb
3. Permits delivery of coolers completed prior to July 3, 1943.
4. Permits assembly of coolers from fabricated parts on hand.

SCHEDULE 2—Refrigeration Condensing Units (All Types)

1. Prohibits units below 1/6 hp
2. Prohibits water cooled units below 3 hp except:
   (a) Installation where ambient temperature is 110F or higher;
   (b) installation in air-tight room or enclosure; and
   (c) for low temperature applications—minus 40F and below.
3. Prohibits air cooled units above 2 hp except 3 hp air cooled units for Army.
4. Prohibits duplex units 20 hp and below.
5. Basic compressor bodies limited to one-half the number of models by hp rating.
6. Limits number of models to one for each hp rating for:
   (a) suction temperatures of 50F, 20F, 40F; and
   (b) refrigerant classification of ammonia, carbon dioxide, freon. *(Exception: Motor of larger hp may be used for application below minus 10F)*
7. Motor pulley and belt drive must be shipped with units.
8. No unit to be produced in a hp rating or using a refrigerant not produced prior to May 1, 1942.
9. No metal bases on units less than 3 hp or above 20 hp. *(Exception: Aboard ship, aircraft, advanced bases).*
10. No metal fan shrouds on air cooled units below 3 hp. *(Exception: Aboard ship).*
11. Copper tubing for interconnecting refrigerant lines prohibited larger than 3.4 in. size (O.D.) *(Exception: Aboard ship and at advanced bases).*
12. Permits assembly of fabricated parts in inventory prior to July 3, 1943.

SCHEDULE 3—Coil or Tube Assemblies for Condensers or Coolers

1. Prohibits use of non-ferrous metals and seamless steel tubing for all coil or tube assemblies. *(Exception: Water cooled condensers and use aboard ship).*
2. Limits wall thickness of steel tubing except for integral fin tubing.
3. Limits fin thickness to 4% of fin weight or a maximum of .023".
4. Limits use and tin content to protective coating.
   (a) 7% tin.
5. Limits use of copper in water cooled condensers as follows:
   (a) 7 lb per hp for self-contained units
   (b) 7 lb per ton for suction temperature above 30F
   (c) 8 lb per ton for suction temperature 0 to 30F
   (d) 9 lb per ton for suction temperature below 0F
6. Permits assembly from fabricated parts in inventory prior to September 2, 1942.

SCHEDULE 4—Refrigeration Valves, Fittings, Accessories, Other Parts.

1. Limits sizes and types of valves, fittings and accessories.
2. Restricts use of non-ferrous metals for some valves and accessories.
3. Restricts use of stainless steel except for small essential parts.
4. Permits completion of valves, fittings and accesories in process, not in conformity with the schedule, for a period of 60 days.
5. Permits sizes and types not in conformity with schedule for repair and maintenance.
   *(Exception given use aboard ship and in advanced bases.)*

SCHEDULE 5—Commercial Reach-in and Walk-in Refrigerators.

1. Permits only four sizes of reach-ins—20, 45, 65 and 85 cu ft.
2. Permits only nine sizes of walk-ins (sizes in feet) 6 x 6, 6 x 8, 8 x 8, 8 x 10, 10 x 12, 10 x 16, 10 x 20, 10 x 24, 10 x 30.
   All 76 in. high.
3. Use of non-ferrous metals limited to:
   (a) High side
   (b) Low side
   (c) Motor and controls
   (d) Refrigerant connections (not over 3.4 in. O.D.)
   (e) Galvanizing.
4. Use of ferrous metals limited to:
   (a) High side
   (b) Low side
   (c) Miscellaneous fittings and hardware
   (d) Drains
   (e) Thresholds
   (f) Ice bunkers
   (g) Floors—22 gauge
   (h) Wire mesh.
5. *Exceptions—Aboard ship for reach-ins; aboard ship and advanced bases for walk-ins.*
6. Permits assembly from fabricated parts in inventory.

SCHEDULE 6—Refrigerant and Service Connections.

1. Prohibits the use of copper tubing for refrigerant connections except for self-contained systems, maximum length of 15 ft for non-selfcontained systems; and then only providing the tubing is not larger than ¾ in. O.D.
2. Prohibits the use of copper tubing for service connections.
   *(Exceptions: Aboard ship and advanced bases).*

## Civilian Supply Set-up Likely

Although WPB contends that the proper operation of the war production machine is dependent upon such limitation orders as L-38, L-126 and the hundreds of others vitally affecting other industries, a movement is on foot in Washington to give Civilian Supply a voice equal with that of Army, Navy, Maritime Commission and the half-dozen other "using agencies" whose claims now come first when materials and manpower are involved.

Before the Senate Banking and Currency Committee, hearings are being held on Senate Bill 885, which would create an Office of Civilian supply backed by sufficient power to enforce its decisions.

As explained before the committee by Joseph L. Weiner, present director of the Office of Civilian Supply, war needs have entered the material and manpower markets with such power behind their demands that essential civilian needs have been virtually eclipsed. Although civilian supply officers are permitted to appear in the background when material and manpower problems are considered, they may petition but not demand the consideration given the other using agencies.

It is Mr. Weiner's contention that maintenance of certain phases of civilian economy are as essential to successful carrying out of the war program as is the actual production program itself.

As explained before the Senate Committee, Mr. Weiner believes it penny wise and pound foolish to deny essential civilian economy the infinitesimal quantities of metals, manpower and materials it needs to keep up certain phases of morale, health and satisfaction that actually determine the productivity of workers.

## Senators Hear Argument

"The present position of civilian economy dictates the immediate establishment of an Administration of Civilian Supply, empowered to assure a home front that will balance the needs of the war front," OCS Director Weiner told the Senate Committee considering the Civilian Supply Bill.

"In 1943 only 1½% of the total steel will go into consumer goods; only 7% of the copper used in 1940—a fairly normal year—and only 6% of the rubber used in 1940. Inventory withdrawals have protected civilians to date, but the real pinch is yet to come. So far the only pinch felt has been due to material shortages; now manpower, transportation, fuel and services are involved.

"How skinny the civilian economy will become depends upon the length of the war. At present no one expects the bottom to drop out. Estimates for 1943 indicate that consumer goods will be 15% below 1942 during the first half of this year; perhaps 20% during the second half. But the figures do not tell the whole story. Quality reduction is an important factor not shown—quality reduction like the substitution of wooden springs for steel in beds and furniture.

"Three immediate steps are necessary.

"First, establishment of a Civilian Supply Administration empowered to determine civilian essentials — not only in terms of what the individual needs less than does the military, but in terms of how such a lack on the part of the individual may affect the military program.

"For instance, in several areas it has been determined that the lack of laundry services, or transportation, or heat, or recreational facilities has materially reduced the output of war goods the worker was supposed to produce. In other cases indiscriminate inductions from civilian occupations have had serious repercussions in related war industries.

"The next step after determining the minimum civilian requirements as they affect the war program is to translate these needs not only into terms of civilian goods, but into terms of manpower, services, transportation, fuel and the other factors necessary to produce and maintain them. If the survey of essentials must be scaled down, then translate this scaling down all the way along the line. Or if certain parts must be built up, allowances should be made for each of the interlocking factors required in production and distribution of the entire program.

"The third step would then be the determination of how allocations of available materials and manpower may be distributed between competing civilian demands. As an example, the amount of critical materials needed for the repair of individual pieces of consumer goods is small. All of the mechanical refrigerators in the country would require only 500 tons of steel and small amounts of other materials; repair of all the sewing machines would require only 230 tons of carbon steel and four tons of alloy; and the 12,000,000 vacuum cleaners could all be kept in good condition with 140 tons of steel, 14 tons of aluminum, 72 tons of alloy steel and 34 pounds of copper."

## Favorable Action Likely

Indications in Washington are that Congress will act favorably on petitions to give civilian economy an equal voice at WPB council tables. It is also considered likely that Mr. Weiner will continue as the wheelhorse of the civilian supply team, but that some big-name executive will be brought in as Administrator.

If the new Administration of Civilian Supply functions as outlined it may be in a position to rectify some of the admitted errors of omission that have resulted, quite naturally, when powerful "using agencies" have presented pleas based primarily upon the desire of their directors to do an assigned job rather than to temper it with consideration for the all-over picture of the home front.

# MARCH WASHINGTON NEWS HIGHLIGHTS

EDITOR'S NOTE:—Supplementing its regular summary of Washington News, HEATING AND VENTILATING publishes the following monthly index to press releases and other government-issued material of particular interest to those affiliated with heating, ventilating and air conditioning industries. Copies of releases of publications listed may be secured by writing U. S. Information Center, 1400 Pennsylvania Ave., Washington, D. C. Dates of March releases, together with reference numbers which should be included in requesting copies, follow:

27th—ORDER L-38 LIMITS A-C AND REFRIGERATION. Stricter controls over production and delivery of all refrigerating and air conditioning equipment except domestic refrigerators and farm milk coolers established by amendment of WPB General Limitation Order L-38. WPB-2978.

27th—ORDER L-126 STANDARDIZES A-C CONSTRUCTION. Materials authorized for use in constructing refrigerating and air conditioning equipment permitted by Order L-38 are defined in WPB General Order L-126, amended. WPB Order L-126.

26th — CONSTRUCTION CONTROL EXPLAINED. In curtailing construction, WPB has sought to divert into channels which will contribute directly to winning the war vast amounts of material and labor which were formerly expended in public and private construction programs. WPB-2931.

26th—BUILDING PROCEDURE SIMPLIFIED. Simple plan for allotment of controlled materials under CMP for certain types of construction costing less than $10,000 announced by WPB. WPB-2970.

25th—INSURANCE FOR 90,000 HOMES. Insured mortgage financing for 90,000 additional units of private war housing has been made available through amendments to National Housing Act just approved by President Roosevelt. OWI-1409.

24th—PURCHASING FOR HOUSING EASED. WPB announced purchase orders for rated materials going into privately-financed housing construction will no longer require authentication by Federal Housing Administration field offices. WPB-2922.

24th — $1,158,819 IN CONSTRUCTION STOPPED. Construction projects having a total value of $1,158,819 were halted during the week ending March 19. WPB-2927.

22nd—CONSTRUCTION TO BE PRICE FREE. Most parts of construction industry not already exempt from price control soon will be removed from regulation, Price Administrator Brown announced today. Repair and maintenance services, which are a factor in civilian rents, will remain under control. OPA-2038.

20th—92,000 HOUSING UNITS BEGUN. 92,000 publicly financed housing units for war workers were placed under contract during first two months of 1943, Commissioner Herbert Emmerich of FPHA announced today. OWI-1447.

20th — PAW SUB-OFFICES ESTABLISHED. Deputy Petroleum Administrator Ralph K. Davies announced today that sub-offices of the Petroleum Administration for War have now been established for the six District One zones into which PAW has divided the Atlantic Seaboard states. OWI-1472.

20th—CONSTRUCTION VOLUME DECLINES. Total volume of construction in United States declined 14% from December to January, continuing downward trend for fifth consecutive month. WPB-2899.

20th—TANK BARGES FOR CHARTERERS. ODT announced today that fleet of 500 wooden petroleum tank barges, 21 towboats and 100 tugboats now under construction to step up flow of oil to East will be operated by private companies on charter basis. ODT-150.

18th— PAW HAS PLANNING STAFF. Setting up of Organization Planning staff in the office of the Petroleum Administration for War, with Lounsbury S. Fish in charge as director, was announced today. OWI-1458.

17th—OIL RATIONING PLAN DISCUSSED. Simplification of fuel oil rationing plan to aid petroleum industry in meeting manpower problems was discussed at meetings March 16 and 17 between Fuel Oil Industry Advisory Committee and OPA. OPA-1988.

12th—COKE ALLOCATION BASIS SET. Order under which coke made from bituminous coal can be allocated, if such action becomes necessary, was issued today by WPB in Conservation Order M-292. WPB-2824.

12th—NEW OIL BOX-CAR ANNOUNCED. Improved type of box-car petroleum carrier may soon be helping to solve East's oil drought as result of experimental efforts of B. & O. railroad, ODT said today. ODT-137.

10th—CERTAIN UTILITY CONNECTIONS ALLOWED. Advance approval of limited utility connections for construction or remodeling projects permitted under L-41 is granted in Supplemental Utilities Order U-1-d, effective March 15. WPB-2805.

10th—FUEL OIL RATIONS LIMITED. Fuel oil users who would be entitled to receive auxiliary rations of 100 gallons or more for heating purposes will not be issued such rations if they can obtain extra heat from coal or wood stoves, OPA announced today with amendment 47 to Rationing Order 11. OPA-1898.

9th—NEW ENGLAND OIL 75.9% NORMAL. Heating oil sales in New England by 13 principal supplying companies amounted to 75.9% of normal October through January. OWI-1406.

8th—MATERIALS TO FINISH PIPELINE ASKED. Petroleum Administrator for War Ickes today announced he had formally applied to WPB for materials necessary to complete the New York and Philadelphia terminals 20-inch petroleum products pipeline soon to be started from Texas. OWI-1398.

7th—COAL PRODUCTION REACHES NEW HIGH. Bituminous coal production reached an estimated 12,680,000 tons in the week ended February 27, the highest production in 16 years, Solid Fuels Coordinator Harold Ickes announced. OWI-1388.

7th—ELIMINATING FRILLS SAVES MATERIALS. By eliminating unnecessary frills in scores of articles from hairpins to industrial power trucks, WPB in 1942 saved 600,000 tons of steel, 17,000 tons of copper, large quantities of other materials and enough man-hours to build 23 liberty ships. WPB-2769.

4th $1,066,990,976 IN PROJECTS APPROVED. Construction projects having total cost of $1,066,990,976 have been approved by WPB in the last four months. WPB-2737.

3rd—PIPE FLANGE RULE AMENDED. Schedule 2 of Limitation Order L-42 has been amended to permit greater use of grey iron and malleable iron in pipe flange manufacture. WPB-2726.

2nd—COLLIER'S RESIGNATION ACCEPTED. Resignation of Robert T. Collier as director of the marketing division of the Petroleum Administration for War has been accepted. OWI-1362.

2nd—L-252 ERRORS CORRECTED. Limitation Order L-252 has been revised to exempt valves, cast or forged, before May 1, 1943. WPB-2697.

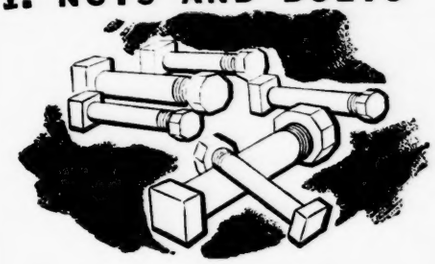
# Welding piping with Tube-Turn fittings conserves 4 vital materials . . . checks war-time pipe failures, stops leaks!

NO. 4 OF A SERIES

HOW TUBE-TURN WELDING FITTINGS BENEFIT WAR INDUSTRY

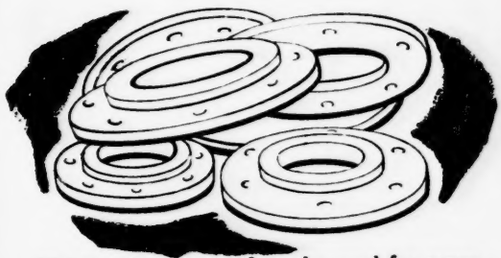
The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

## 1. NUTS AND BOLTS



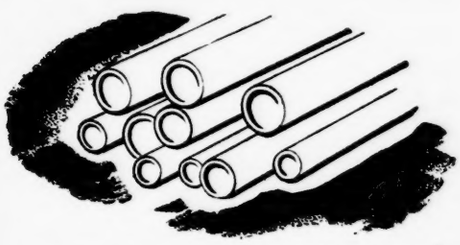
Joints welded with Tube-Turn fittings require no nuts or bolts. Maintenance time and trouble spent in tightening bolts is eliminated.

## 2. FLANGES



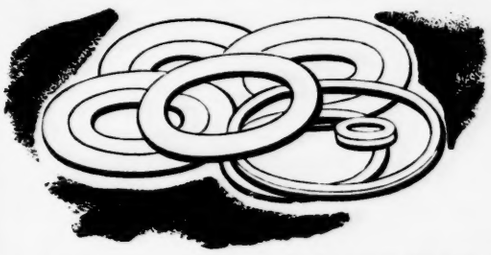
Welding fittings supplant the need for many of the flanged joints necessary in screwed piping—save both weight and critical metal.

## 3. PIPE REPLACEMENT



When welding fittings are used, you never have to replace any pipe because of worn threads or damage due to replacing flanged fittings.

## 4. GASKET MATERIAL



Fewer flanged joints mean fewer gaskets to replace. No materials or time wasted when connections are welded with Tube-Turn fittings.

When you multiply these savings over an entire piping system, the amount of critical materials conserved is tremendous. Tube-Turn welding fittings aid the war effort in *other* ways, too—less danger of plant shut-downs due to piping failures; maintenance is virtually eliminated; less installation time is needed because alignment is easier, only simple butt welds are required, and complete sections may be pre-assembled then welded into position. For *stronger, lighter, permanently leakproof* piping systems—weld with Tube-Turn fittings!

TUBE-TURNS (INC.) LOUISVILLE, KY. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Tulsa, Houston, Los Angeles. *Distributors in principal cities.*

# TUBE-TURN

TRADE MARK

*Welding Fittings and Flanges*

# DEGREE-DAYS FOR FEBRUARY, 1943

HEATING AND VENTILATING'S 15th year of publication of monthly degree-day data

| City | Monthly Degree-Days | | | Cumulative Degree-Days | | | Year[1] |
|---|---|---|---|---|---|---|---|
| | Degree-Days, Feb., 1943 | Degree-Days, Feb., 1942 | Degree-Days, Feb., Normal | Season, 9/1/42-2/28/43 | Season, 9/1/41-2/28/42 | Season, Normal 9/1-2/28 | Normal, 9/1-6/30 |
| Abilene, Texas | 332 | 447 | 510 | 1855 | 2011 | 1761 | 2061 |
| Albany, New York | 1144 | 1237 | 1142 | 5311 | 4912 | 4868 | 6580 |
| Albuquerque, New Mexico | 599 | 805 | 692 | 2915 | 3410 | 3443 | 4298 |
| Alpena, Michigan | 1210 | 1287 | 1278 | 5637 | 5168 | 5660 | 8299* |
| Anaconda, Montana | 1029 | 1265 | 1164 | 5537 | 6017 | 5656 | 8357** |
| Asheville, North Carolina | 702 | 881 | 756 | 3088 | 3117 | 3276 | 4232 |
| Atlanta, Georgia | 510 | 712 | 557 | 2219 | 2366 | 2370 | 2890 |
| Atlantic City, New Jersey | 812 | 924 | 904 | 3377 | 3254 | 3631 | 5176 |
| Augusta, Georgia | 399 | 566 | 423 | 1717 | 1848 | 1864 | 2161 |
| Baker, Oregon | 919 | 1029 | 991 | 4909 | 5100 | 5024 | 7163 |
| Baltimore, Maryland | 732 | 855 | 843 | 3275 | 2993 | 3462 | 4533 |
| Billings, Montana | 909 | 1197 | 1120 | 5160 | 5237 | 5254 | 7119 |
| Binghamton, New York | 1069 | 1198 | 1182 | 4900 | 4545 | 4965 | 6808 |
| Birmingham, Alabama | 444 | 611 | 521 | 1938 | 2151 | 2023 | 2352 |
| Bismarck, North Dakota | 1390 | 1353 | 1548 | 7048 | 5903 | 6869 | 9192 |
| Block Island, Rhode Island | 940 | 1025 | 983 | 4024 | 3762 | 3767 | 5788 |
| Boise, Idaho | 815 | 939 | 848 | 4201 | 4587 | 4230 | 5552 |
| Boston, Massachusetts | 967 | 1058 | 1042 | 4362 | 4012 | 4322 | 6045 |
| Bozeman, Montana | 1063 | 1388 | 1208 | 5652 | 6322 | 5897 | 8521** |
| Buffalo, New York | 1096 | 1234 | 1156 | 4946 | 4559 | 4768 | 6822 |
| Burlington, Vermont | 1245 | 1361 | 1294 | 5847 | 5574 | 5496 | 7514 |
| Butte, Montana | 1139 | 1413 | 1143 | 6088 | 6673 | 5635 | 8272 |
| Cairo, Illinois | 627 | 792 | 762 | 2968 | 3049 | 3169 | 3909 |
| Canton, New York | 1271 | 1397 | 1328 | 6052 | 5752 | 5842 | 8020 |
| Charles City, Iowa | 1243 | 1238 | 1273 | 5997 | 5126 | 5728 | 7588 |
| Charleston, South Carolina | 395 | 556 | 372 | 1487 | 1540 | 1491 | 1769 |
| Charlotte, North Carolina | 509 | 697 | 588 | 2373 | 2376 | 2533 | 3120 |
| Chattanooga, Tennessee | 552 | 770 | 602 | 2556 | 2856 | 2559 | 3118 |
| Cheyenne, Wyoming | 877 | 1224 | 1075 | 4806 | 5311 | 5179 | 7466 |
| Chicago, Illinois | 1042 | 1076 | 1083 | 4946 | 4157 | 4276 | 5957 |
| Cincinnati, Ohio | 824 | 967 | 862 | 3759 | 3559 | 3675 | 4684 |
| Cleveland, Ohio | 964 | 1109 | 1075 | 4317 | 4028 | 4441 | 6155 |
| Columbia, Missouri | 746 | 909 | 897 | 3808 | 3556 | 3903 | 4922 |
| Columbia, South Carolina | 429 | 595 | 498 | 1863 | 1923 | 2000 | 2364 |
| Columbus, Ohio | 897 | 1018 | 980 | 4018 | 3788 | 4113 | 5398 |
| Concord, New Hampshire | 1189 | 1235 | 1240 | 5564 | 5246 | 5321 | 7353 |
| Concordia, Kansas | 770 | 981 | 970 | 4168 | 3984 | 4173 | 5315 |
| Dallas, Texas | 346 | 474 | 493 | 1825 | 2022 | 1980 | 2256 |
| Davenport, Iowa | 1025 | 1107 | 1140 | 4948 | 4293 | 4825 | 6289 |
| Dayton, Ohio | 865 | 1021 | 980 | 3991 | 3805 | 4043 | 5264 |
| Denver, Colorado | 682 | 1138 | 918 | 3720 | 4404 | 4273 | 5874 |
| Des Moines, Iowa | 998 | 1128 | 1173 | 4989 | 4456 | 4935 | 6384 |
| Detroit, Michigan | 1034 | 1186 | 1134 | 4869 | 4362 | 4718 | 6490 |
| Devils Lake, North Dakota | 1516 | 1493 | 1551 | 7605 | 6545 | 7371 | 9970 |
| Dodge City, Kansas | 667 | 932 | 890 | 3645 | 3735 | 3958 | 5035 |
| Dubuque, Iowa | 1122 | 1142 | 1218 | 5373 | 4575 | 5194 | 6790 |
| Duluth, Minnesota | 1409 | 1369 | 1464 | 6905 | 6027 | 6680 | 9443 |
| Eastport, Maine | 1135 | 1224 | 1232 | 5539 | 5349 | 5502 | 8520** |
| Elkins, West Virginia | 925 | 1083 | 1048 | 4008 | 4058 | 3265 | 5697 |
| El Paso, Texas | 389 | 473 | 434 | 1857 | 1955 | 2101 | 2428 |
| Ely, Nevada | 1013 | 1160 | (a) | 5091 | 5620 | (a) | (a) |
| Erie, Pennsylvania | 1028 | 1159 | 1098 | 4483 | 4136 | 4434 | 6273 |
| Escanaba, Michigan | 1307 | 1263 | 1340 | 6059 | 5380 | 6028 | 8771* |
| Evansville, Indiana | 756 | 886 | 854 | 3596 | 3505 | 3348 | 4244 |
| Fort Smith, Arkansas | 469 | 647 | 630 | 2417 | 2618 | 2657 | 3147 |
| Fort Wayne, Indiana | 1027 | 1181 | 1098 | 4873 | 4438 | 4503 | 5925 |
| Fort Worth, Texas | 339 | 476 | 498 | 1821 | 2011 | 1904 | 2148 |
| Fresno, California | 376 | 450 | 389 | 2024 | 1951 | 1883 | 2334 |
| Galveston, Texas | 169 | 306 | 255 | 836 | 1100 | 938 | 1016 |
| Grand Junction, Colorado | 733 | 1021 | 863 | 3710 | 4314 | 4374 | 5548 |
| Grand Rapids, Michigan | 1053 | 1180 | 1204 | 4893 | 4385 | 4863 | 6535 |
| Green Bay, Wisconsin | 1266 | 1260 | 1358 | 5879 | 5095 | 5778 | 7825 |
| Greensboro, North Carolina | 636 | 797 | 678 | 2929 | 2963 | 2845 | 3529 |
| Greenville, South Carolina | 543 | 709 | 661 | 2394 | 2412 | 2739 | 3389 |
| Harrisburg, Pennsylvania | 880 | 985 | 1008 | 3987 | 3775 | 4077 | 5357 |
| Hartford, Connecticut | 1037 | 1088 | 1100 | 4640 | 4354 | 4416 | 6036 |
| Hatteras, North Carolina | 504 | 654 | 535 | 1834 | 1897 | 1851 | 2571 |
| Havre, Montana | 1101 | 1374 | 1450 | 6249 | 5716 | 6388 | 8790 |
| Helena, Montana | 1216 | 1387 | 1178 | 6057 | 6372 | 5611 | 7898 |
| Houston, Texas | 159 | 327 | 277 | 984 | 1200 | 1092 | 1157 |
| Huron, South Dakota | 1167 | 1249 | 1340 | 6268 | 5214 | 6075 | 8094 |
| Indianapolis, Indiana | 932 | 1016 | 969 | 4194 | 3738 | 4099 | 5298 |
| Ithaca, New York | 1059 | 1224 | 1145 | 4914 | 4624 | 4851 | 6719 |
| Kansas City, Missouri | 738 | 923 | 946 | 3838 | 3525 | 3953 | 4956 |
| Kewanee, Illinois | 1079 | 1929 | 1106 | 5170 | 4071 | 4640 | 6139 |
| Knoxville, Tennessee | 640 | 807 | 666 | 2810 | 2853 | 2964 | 3670 |
| La Crosse, Wisconsin | 1222 | 1229 | 1265 | 5913 | 4949 | 5578 | 7322 |
| Lander, Wyoming | 943 | 1439 | 1155 | 5350 | 6331 | 5666 | 7947 |

[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

Figures in this table, with eight exceptions, based on local weather bureau reports. Exceptions are Utica, Lewiston, Kewanee, and Sioux City, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; Norman E. Ross, Bursar, Bates College, Lewiston, Me.; J. M. Hartman, Engineering Department, Kewanee Boiler Corp., Kewanee, Ill., and Alfred R. Wagstaff, Engineer, Sioux City Foundry and Boiler Co., Sioux City, Iowa, respectively; Anaconda, Bozeman, Butte and Livingston, Mont., through the courtesy of the Montana Power Company.

(a) Data not available.

[Table Concluded on Page 74]

# Springboard for Airpower

Just strips of steel 18 inches wide by 10 feet long, punched full of holes and made so that when you lay them down side by side, they lock together.

But assemble some thousands of these strips and you have a potent weapon—a military runway. Runways made in this way are serving as springboards from which Flying Fortresses, Grumman Wildcats and A-20-A's are being launched against the Japanese north of Guadalcanal, and against the Nazis in North Africa.

Bethlehem's main job in the landing mat program is supplying a tremendous tonnage of sheet steel to many fabricators for processing into these mats. Monthly production has been growing fast, and has already reached a figure that might mean something to an enemy ad-reader, so we can't quote. But when you realize that just one military runway eats up 3,000,000 pounds of sheet steel, you get an idea of the magnitude of the program. Supplying steel for landing mats is only one of the many ways in which Bethlehem is working to aid our armed forces.

Due to the great need for landing mats in a hurry, Bethlehem Steel Company has converted a portion of its building specialty department to the production of these mats for the duration of the emergency.

BETHLEHEM STEEL

# Degree-Days for February, 1943 (Concluded)

HEATING AND VENTILATING'S 15th year of publication of monthly degree-day data

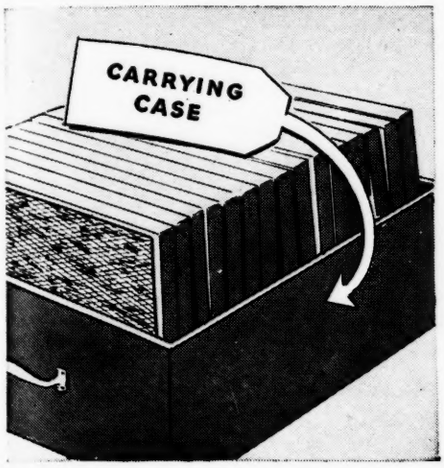
| City | Monthly Degree-Days | | | Cumulative Degree-Days | | | Year[1] |
|---|---|---|---|---|---|---|---|
| | Degree-Days, Feb., 1943 | Degree-Days, Feb., 1942 | Degree-Days, Feb., Normal | Season, 9/1/42-2/28/43 | Season, 9/1/41-2/28/42 | Season, Normal 9/1-2/28 | Normal, 9/1-6/30 |
| Lansing, Michigan | 1107 | 1242 | 1201 | 5266 | 4694 | 5202 | 7048 |
| Lewiston, Maine | 1209 | 1247 | 1243 | 5647 | 5421 | 5532 | 7707 |
| Lincoln, Nebraska | 852 | 1082 | 1131 | 4582 | 4292 | 4643 | 5999 |
| Little Rock, Arkansas | 459 | 648 | 582 | 2364 | 2519 | 2380 | 2811 |
| Livingston, Montana | 900 | 1206 | 1067 | 5083 | 5418 | 5018 | 7205 |
| Los Angeles, California | 174 | 259 | 266 | 757 | 870 | 1016 | 1504 |
| Louisville, Kentucky | 726 | 891 | 801 | 3380 | 3262 | 3327 | 4180 |
| Lynchburg, Virginia | 663 | 789 | 730 | 2943 | 2864 | 3143 | 3980 |
| Macon, Georgia | 428 | 583 | 462 | 1766 | 1969 | 1908 | 2201 |
| Madison, Wisconsin | 1207 | 1248 | 1299 | 5701 | 4917 | 5557 | 7429 |
| Marquette, Michigan | 1266 | 1251 | 1361 | 5989 | 5363 | 5915 | 8693* |
| Memphis, Tennessee | 522 | 699 | 599 | 2429 | 2750 | 2470 | 2950 |
| Meridian, Mississippi | 391 | 544 | 456 | 1742 | 2059 | 1891 | 2160 |
| Milwaukee, Wisconsin | 1178 | 1200 | 1201 | 5482 | 4855 | 5185 | 7245 |
| Minneapolis, Minnesota | 1333 | 1241 | 1400 | 6322 | 5254 | 5950 | 7850 |
| Modena, Utah | 863 | 1024 | 905 | 4340 | 5041 | 4764 | 6562 |
| Montgomery, Alabama | 371 | 542 | 392 | 1532 | 1807 | 1676 | 1884 |
| Nantucket, Massachusetts | 946 | 1019 | 974 | 4021 | 3785 | 3912 | 5957 |
| Nashville, Tennessee | 609 | 765 | 675 | 2760 | 2828 | 2850 | 3507 |
| New Haven, Connecticut | 952 | 1035 | 1011 | 4249 | 3926 | 4230 | 5895 |
| New Orleans, Louisiana | 235 | 348 | 230 | 974 | 1157 | 965 | 1024 |
| New York, New York | 864 | 993 | 960 | 3766 | 3581 | 3869 | 5347 |
| Nome, Alaska‡ | 2081 | 1415 | 1990 | 7566 | 5979 | 7226 | 14580** |
| Norfolk, Virginia | 572 | 732 | 650 | 2344 | 2364 | 2583 | 3350 |
| Northfield, Vermont | 1307 | 1392 | 1380 | 6147 | 5838 | 6178 | 8719* |
| North Head, Washington | 513 | 570 | 622 | 3023 | 2809 | 3132 | 5452** |
| North Platte, Nebraska | 788 | 1130 | 1020 | 4424 | 4646 | 4806 | 6366 |
| Oakland, California | 345 | 3911 | 403 | 1941 | 1834 | 2029 | 3143** |
| Oklahoma City, Oklahoma | 517 | 679 | 742 | 2734 | 2762 | 2986 | 3613 |
| Omaha, Nebraska | 909 | 1132 | 1126 | 4790 | 4493 | 4765 | 6131 |
| Oswego, New York | 1097 | 1208 | 1162 | 5021 | 4715 | 4933 | 7088 |
| Parkersburg, West Virginia | 812 | 970 | 879 | 3624 | 3567 | 3701 | 4775 |
| Peoria, Illinois | 967 | 1072 | 1067 | 4698 | 4141 | 4673 | 6109 |
| Philadelphia, Pennsylvania | 817 | 933 | 893 | 3579 | 3333 | 3629 | 4855 |
| Phoenix, Arizona | 161 | 341 | 263 | 895 | 1155 | 1253 | 1405 |
| Pittsburgh, Pennsylvania | 871 | 1027 | 944 | 3859 | 3680 | 3947 | 5235 |
| Pocatello, Idaho | 952 | 1304 | 986 | 4680 | 5677 | 4853 | 6655 |
| Portland, Maine | 1178 | 1211 | 1162 | 5507 | 5170 | 5088 | 7218 |
| Portland, Oregon | 527 | 583 | 644 | 2943 | 2975 | 3174 | 4469 |
| Providence, Rhode Island | 942 | 1030 | 1070 | 4261 | 4017 | 4316 | 6015 |
| Pueblo, Colorado | 693 | 1033 | 916 | 3787 | 4405 | 4140 | 5514 |
| Raleigh, North Carolina | 540 | 727 | 630 | 2467 | 2471 | 2605 | 3234 |
| Rapid City, South Dakota | 907 | 1177 | 1119 | 5279 | 4875 | 5140 | 7118 |
| Reading, Pennsylvania | 881 | 984 | 980 | 3920 | 3679 | 4082 | 5389 |
| Redding, California | 353 | 562 | 418 | 1947 | 2076 | 1951 | 2451 |
| Reno, Nevada | 700 | 844 | 823 | 3779 | 4146 | 4149 | 5892 |
| Richmond, Virginia | 640 | 786 | 695 | 2856 | 2839 | 2906 | 3695 |
| Rochester, New York | 1081 | 1253 | 1159 | 5035 | 4714 | 4825 | 6732 |
| Roseburg, Oregon | 485 | 582 | 605 | 2718 | 2819 | 3090 | 4428 |
| Roswell, New Mexico | 469 | 658 | 580 | 2371 | 2762 | 2876 | 3484 |
| Sacramento, California | 377 | 423 | 426 | 1956 | 1922 | 2036 | 2653 |
| St. Joseph, Missouri | 790 | 990 | 974 | 4153 | 3869 | 4121 | 5161 |
| St. Louis, Missouri | 701 | 868 | 854 | 3510 | 3315 | 3652 | 4585 |
| Salt Lake City, Utah | 878 | 1062 | 885 | 4142 | 4612 | 4144 | 5555 |
| San Antonio, Texas | 192 | 316 | 274 | 1159 | 1317 | 1128 | 1202 |
| San Diego, California | 163 | 260 | 280 | 803 | 831 | 1099 | 1645 |
| Sandusky, Ohio | 979 | 1120 | 1061 | 4462 | 4056 | 4384 | 6208 |
| San Francisco, California | 286 | 327 | 356 | 1650 | 1547 | 1770 | 3264** |
| Sault Ste. Marie, Michigan | 1365 | 1407 | 1487 | 4974 | 6062 | 6315 | 9285** |
| Savannah, Georgia | 313 | 476 | 316 | 1234 | 1319 | 1323 | 1490 |
| Scranton, Pennsylvania | 1025 | 1146 | 1106 | 4598 | 4307 | 4552 | 6129 |
| Seattle, Washington | 553 | 589 | 647 | 3066 | 2909 | 3297 | 4934** |
| Sheridan, Wyoming | 905 | 1209 | 1160 | 5167 | 5507 | 5789 | 8008 |
| Shreveport, Louisiana | 328 | 495 | 412 | 1682 | 1961 | 1736 | 1938 |
| Sioux City, Iowa | 1010 | 1213 | 1260 | 5459 | 4929 | 5278 | 6898 |
| Spokane, Washington | 889 | 951 | 952 | 4713 | 4805 | 4707 | 6355 |
| Springfield, Illinois | 829 | 981 | 1008 | 4145 | 3747 | 4191 | 5373 |
| Springfield, Missouri | 687 | 864 | 876 | 3459 | 3524 | 3523 | 4428 |
| Syracuse, New York | 1105 | 1249 | 1212 | 5125 | 4748 | 4980 | 6893 |
| Tacoma, Washington | 602 | 623 | 675 | 3287 | 3191 | 3438 | 5181** |
| Terre Haute, Indiana | 814 | 968 | 966 | 3944 | 3647 | 3876 | 4872 |
| Toledo, Ohio | 1023 | 1166 | 1075 | 4727 | 4252 | 4467 | 6077 |
| Topeka, Kansas | 728 | 914 | 935 | 3855 | 3612 | 3953 | 4969 |
| Trenton, New Jersey | 872 | 977 | 941 | 3876 | 3642 | 3715 | 4933 |
| Utica, New York | 1061 | 1305 | 1181 | 5299 | 5000 | 4966 | 6796 |
| Valentine, Nebraska | 920 | 1157 | 1130 | 5209 | 4978 | 5225 | 7039 |
| Walla Walla, Washington | 732 | 753 | 778 | 3722 | 3866 | 3676 | 4808 |
| Washington, D. C. | 732 | 861 | 848 | 3279 | 3103 | 3559 | 4626 |
| Wichita, Kansas | 690 | 874 | 896 | 3654 | 3528 | 3773 | 4673 |
| Williston, North Dakota | 1361 | 1391 | 1495 | 6997 | 5997 | 6958 | 9323 |
| Winnemucca, Nevada | 723 | 935 | 905 | 4047 | 4605 | 4644 | 6427** |
| Yakima, Washington | 779 | 777 | 846 | 4389 | 4184 | 4433 | 5599 |

‡Nome data are for January.

*Includes August. **Includes July and August.

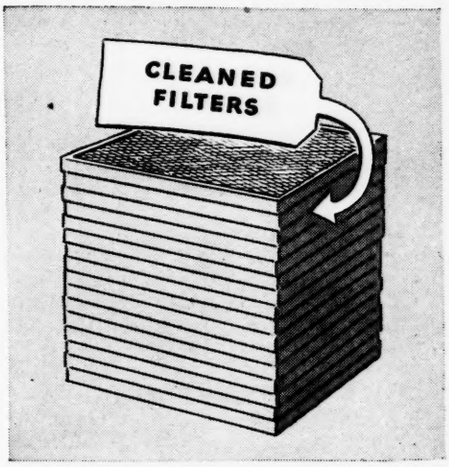
[1]Figures in this column are normal totals for a complete heating season, September to June, incl.

# THE OLD WAY LOOKS PRETTY QUAINT TODAY

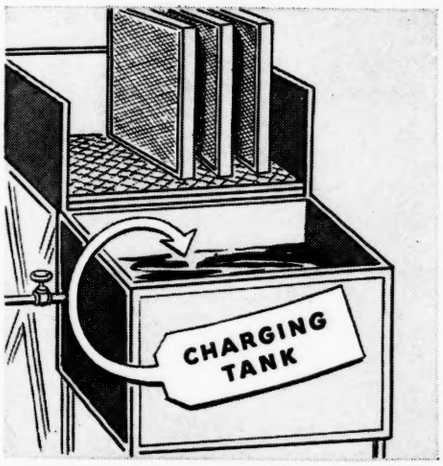



**1 CARRYING CASE.** It kept oil-adhesive on dirty filters from dripping on the floor as the filters were carried to cleaning room.

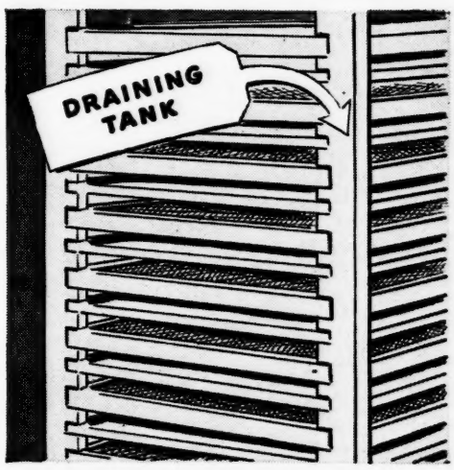
**2 CLEANING VAT.** This was filled with a detergent. The filters were dipped in the solution, moved up and down to remove dust and dirt particles.



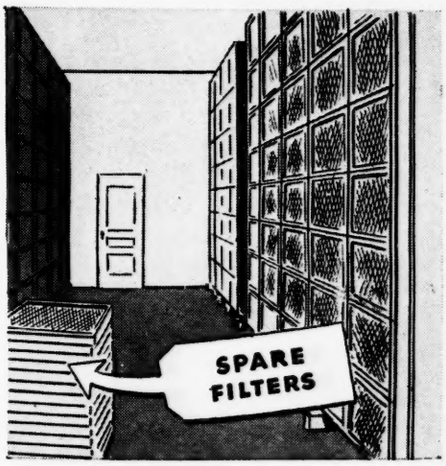

**3 CLEANED FILTERS.** After the filters came out of the vat, they were clean. But look at the jobs that followed!




**4 CHARGING TANK.** First, they had to be dipped in a tank and charged with a clean adhesive . . . more work followed.

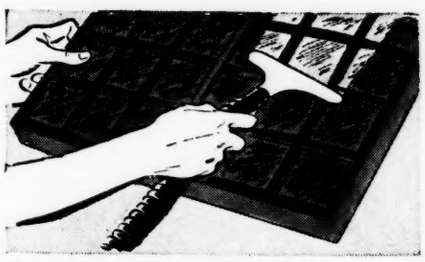



**5 DRAINING RACK.** Then they had to be sure that excessive adhesive was drained off to prevent its being carried into the air stream. It took several hours for the filters to drain.




**6 TIME AND TROUBLE.** All this tied up workmen from other jobs; it was necessary to shut down the equipment or keep a number of "spares" on hand.

# Compare modern Dust-Stop* way with old methods



Dust-Stops are easily and quickly removed. Intake face of filters are vacuumed or gently rapped out to remove surface dirt accumulations. There's nothing more to do . . . no washing, charging, draining, storing.

After a few such cleanings, the face filters are removed and replaced with new filters.

In many installations it is as economical to replace Dust-Stops at regular intervals without intermediate cleaning.

Think of the man hours of labor that are saved! Dust-Stops cost only 1¢ per CFM to install; less than 1/10th of 1¢ per CFM to replace. Do you wonder that Dust-Stops are the largest-selling filters today? Do you wonder that they are used in nearly every type of war industry? Write for complete information.

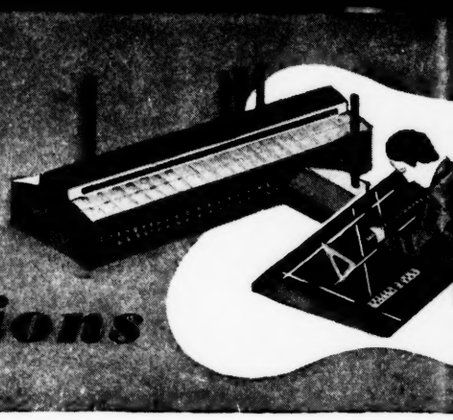
*Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

ARMY (E) NAVY

## FIBERGLAS* DUSTOP* AIR FILTERS

*T. M. Reg. U.S. Pat. Off.

# REVIEWS of TECHNICAL publications



## INDUSTRIAL VENTILATION

**"What the Foundation Plant Surveys Are Disclosing," by Dr. Francis R. Holden, Industrial Hygienist. Industrial Hygiene Foundation, Pittsburgh, Pa.**

In a paper presented November 10, 1942, at the seventh annual meeting at Mellon Institute, Pittsburgh, Dr. Holden discussed some of the most commonly found misuses of industrial ventilation as noted in his investigations. One of these is the failure to provide adequate make-up air to offset the air exhausted from rooms by spray booth fans and the like, the result being that the room is under more or less of a vacuum which causes the exhausted fumes, or noxious fumes or dust from other sources, to be drawn back into the room through various openings. Similarly, flexible ventilating systems used for the removal of dust from freight cars while being loaded often are rendered useless by workmen leaving all suction lines open when only a few in the system are in use and when the system is not designed for simultaneous use of all outlets.

## ASHVE GUIDE

**"Heating, Ventilating and Air Conditioning Guide, 1943 Edition." Published by the American Society of Heating and Ventilating Engineers, 51 Madison Avenue, New York, N. Y. Price, $5.**

The new edition is extensively revised and rearranged and contains considerable new information which should be useful to engineers in the armed services and to heating, ventilating, and air conditioning engineers in industry. Entirely new material includes chapters on abbreviations, symbols, and standards, also extensive information on state laws and codes relating to heating, ventilating and air conditioning forms. A conservation of materials section also is included.

All material is fully indexed. Blue cloth cover with gold stamping, 1268 pages. Thumb indexed copies available at $5.50 each.

## MINERAL WOOL STANDARD

**"Mineral Wool; Loose, Granulated, or Felted Form in Low Temperature Installations — Commercial Standard CS105-43." Published by U. S. Dept. of Commerce, National Bureau of Standards, Washington, D. C.**

Adoption of a new standard covering physical and chemical requirements of mineral wool for use in low temperature applications is announced, following its written acceptance by manufacturers and technical, distributor, and consumer organizations. Thicknesses for various temperatures, specifications for auxiliary materials, tests, installation requirements, and methods of guaranteeing compliance are included.

## PLUMBING AND PIPING

**"Plumbing Practice and Design," Volume I, by Svend Plum. Published by John Wiley & Sons, Inc., New York. Price, $4.50.**

Plumbing is defined by the author as an activity dealing with domestic services which depend on supply and disposal through a system of pipes, including water, gas, and air. In this treatise he has created a handbook in which the widely-scattered data on the subject is presented in a uniform terminology and in such a practical manner as to be unquestionably a useful tool for solving design problems. Underlying principles rather than the solution of specific problems are emphasized throughout, with the thought in mind that a knowledge of principles will lead to a solution of the problems as they arise. The opening chapter on Corrosion is particularly valuable. Isometric drawings and sectional views lend clearness to the text and are useful in illustrating obscure but important factors in typical installations. Consists of 308 pages, 5⅞ x 9 in., bound in cloth.

## PIPE THREADS

**"The American Standard for Pipe Threads, B2.1-1942," by A. M. Houser and C. B. LePage. Published by the American Standards Association, 29 W. 39th St., New York, N. Y. Price, 75 cents.**

This revised standard supersedes the original published in 1919. A number of refinements and modifications and several additions to the original work have been made. Chief among these is an increase in the truncation of the crest and root of external and internal threads. A complete table of maximum and minimum truncations and equivalent widths of flats are given in the revised work. Also included are a new table on tolerances for reference and working plug and ring gages, as well as new specifications for straight pipe threads.

## HEAT TRANSMISSION

**"Engineering Standards—Part 1. Heat Loss Calculations." Published by the Heating, Piping, and Air Conditioning Contractors Association, 1250—6th Avenue, New York, N. Y.**

The fourth edition of this standard, superseding the previous edition of 1939, leaves the table of exposure factors and their applications unchanged; but heat transmission factors have been revised to conform with the factors of the American Society of Heating and Ventilating Engineers.

A feature of the new edition is its easy legibility due to the large type and spacing used in the tables.

Paper-covered, 28 pages, size 8½ x 11 in.

**FOR LOW-COST HEATING, QUICK INSTALLATION AND METAL CONSERVATION**

# DIRECTHERM
## UNIT HEATERS
## STOKER-FIRED

It is a self-contained unit and can be installed or moved in a few hours. No duct work, radiators, or pipes are necessary.

To tend a Directherm requires a minimum of attention. Once the automatic controls are set, they need not be changed. An unskilled man can take care of it . . . important in these days of labor shortage.

Made in 6 sizes (300,000-1,700,000 BTU).

## AIRTHERM
### MANUFACTURING COMPANY

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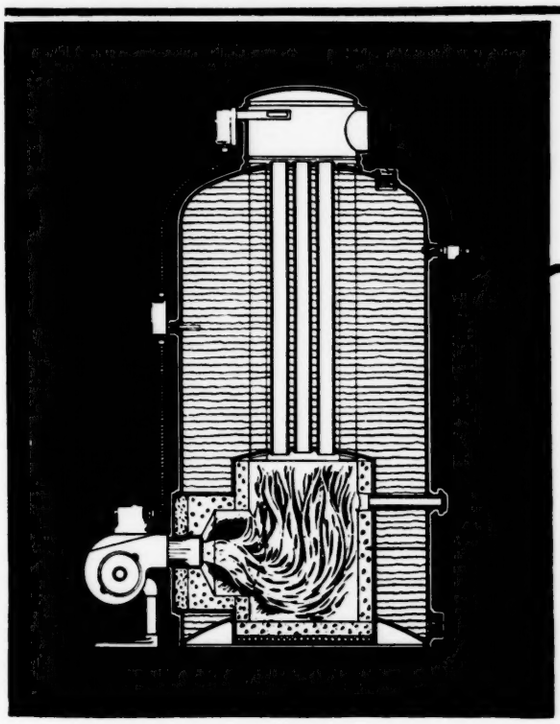

This is our Vertical-self-storage type "Aqulux-225." Other Heavy-Duty Aqulux models include Horizontal, Vertical-Horizontal, Vertical-nominal-storage types.

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*Heavy Duty*
**WATER HEATERS**

## *Johnson*
### gives you more Hot Water from each gallon of Fuel Oil!

Look at these *Efficiency Rating* figures for the Aqulux-225 . . . a typical model of Johnson's heavy duty water heaters:

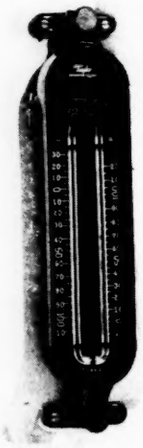
Stack temp. at full capacity.....400° F.
$CO_2$.....12% Stack loss.....14%
Efficiency Rating.....80%

Performance like that pays dividends in lower fuel consumption and shorter recovery time. And don't forget . . . this performance is achieved by Aqualux Heaters built to wartime specifications . . . without insulation, galvanizing or jackets, and with a minimum of copper and aluminum.

The Army, Navy and essential industries are getting practically all that are now available. But a day of Victory is coming . . . soon, we hope . . . when anyone may have them. When that day comes, you will find we are still carrying on the 40-year-old Johnson tradition of fine engineering and fine workmanship in the building of Oil Burning Equipment. S. T. Johnson Co., 940 Arlington Ave., Oakland, Calif. and 401 No. Broad St., Philadelphia, Pa.

## S. T. JOHNSON CO.
*40 years of engineering and building fine Oil Burning Equipment*

# NEW EQUIPMENT

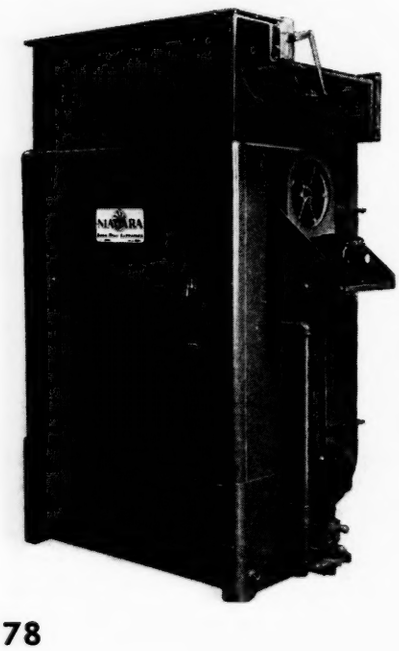


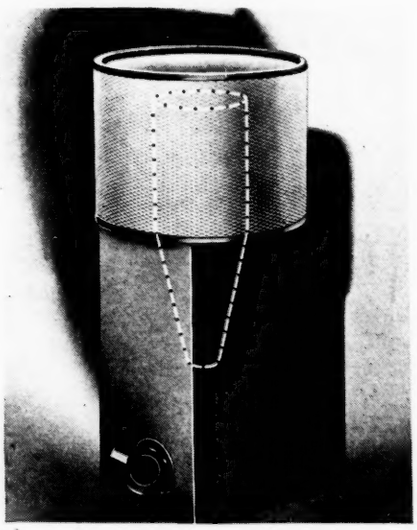
### Plastic Thermometer Case

NAME—Taylor maximum and minimum therometer, with plastic case.
PURPOSE—Used in place of metal-cased thermometers.
FEATURES—With a case made of the plastic Tenite, this new maximum and minimum registering thermometer is said to be dust-proof, tarnish-proof and capable of withstanding exposure in all climates. Particularly recommended for use on shipboard, in greenhouses, dairies, and industrial plants.
MADE BY—*Taylor Instrument Companies, Rochester, N. Y.*

### Heat Exchanger Control

NAME—Control system for Aero heat exchanger.
PURPOSE—To improve operation of industrial liquid coolers.
FEATURES—Apparatus consists of a recirculating air duct through which outside air is admitted by dampers controlled by a thermostat in the line which carries the liquid being cooled. The operating principle is based on controlling the amount of outside air passed through the evaporative cooling chamber rather than by alternating liquid flow. By use of this principle water savings, improvement in accuracy of control, and freedom from settling of solids are claimed. Only a minimum of outside air is admitted and by this means spray water temperature is kept above freezing to prevent damage in cold weather.
MADE BY— *Niagara Blower Corporation, 6 E. 45 St., New York, N. Y.*





### Cyclone-Filter Collector

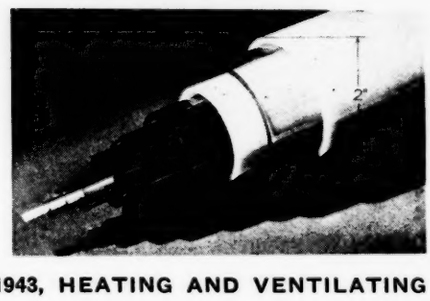
NAME—Model 1250 Dustkop dust collector.
PURPOSE — To exhaust and clean dust-laden air from industrial grinders and polishers.
FEATURES — Unit is portable and entirely self-contained, employing a cyclone separator (indicated by dotted line), a spun glass filter, and a direct-connected multiblade fan. Dirty air from the grinders passes through suction hoses into the bottom of the unit through a multiple connection piece, then passes upward and whirls through the cyclone where the bulk of the dirt particles are removed, and from there passed outwardly through the spun glass filter back into the room. The dirt removed in the cyclone is deposited in a container which is easily removed, and renewal of the filter material, which is said to be seldom required, is relatively inexpensive and easily accomplished.
MADE BY — *Aget-Detroit Mfg. Co., 2040 Book Building, Detroit, Mich.*

### Asbestos-Cement Board

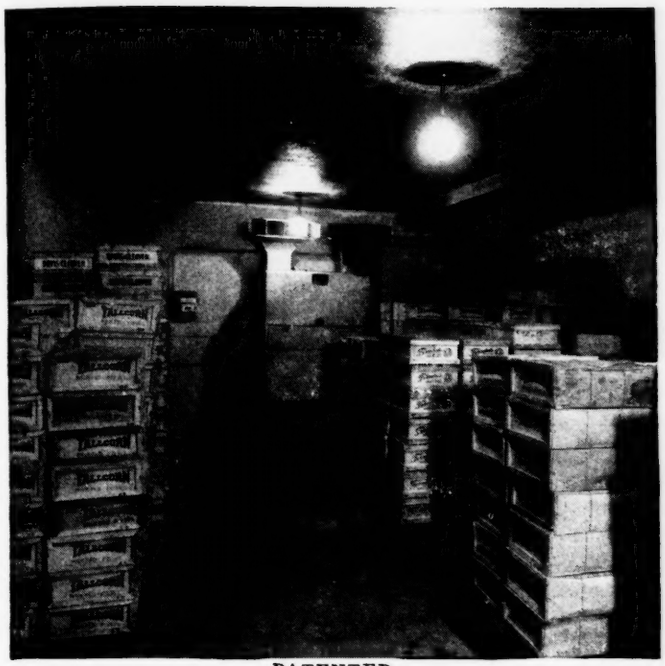
NAME—Stonewall building board.
PURPOSE—For warm and cold air ducts, as a protective finish for steam and hot water boilers and warm air furnaces, for inside and outside wall coverings or partitions, and similar uses.
FEATURES—Made of asbestos fiber and Portland cement this new board is claimed to be fire and vermin proof, proofed against rotting and rusting, to have unusual strength, and to require no paint. Is flexible and easy to work and can readily be sawed, scored, drilled, and nailed.
SIZES—Standard 4 x 8 ft sheets in thicknesses of 3/16, ¼, and ⅜ in.
LITERATURE—Form No. 1190.
MADE BY—*The Ruberoid Co., 500 Fifth Avenue, New York, N. Y.*

### Plastic Tubing

NAME—TULOX TT seamless plastic tubing.
PURPOSE—A substitute for standard metal tubing.
FEATURES—An extruded product made from Tennessee Eastman cellulose acetate butyrate, this new plastic tubing is now available in all diameters up to 2 in. O.D., with range soon to be increased to 2½ in. O.D.
MADE BY—*Extruded Plastics, Inc., Norwalk, Conn.*
DISTRIBUTED BY—*Crane Company, Chicago, Ill., and Julius Blum & Co., Inc., New York, N. Y.*



# INCREASE YOUR PRESENT REFRIGERATION CAPACITY WITHOUT ADDING COMPRESSORS



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● The NIAGARA "No-Frost" Method eliminates the progressive icing of refrigeration coils with the attendant loss of refrigeration. It enables you to refrigerate additional space without adding to compressor load —or to save power in present operation.

In addition, the Niagara DUO-PASS AERO CONDENSER increases refrigeration capacity by reducing head pressures. This has been proved by users' power costs reduced as much as 35% when the use of refrigeration capacity was not increased.

Save power and money, or increase refrigerated space by using these machines. For ample assurance of these benefits write for information on users' experience and for Niagara Bulletins 83, 91 and 95. Dept.HV-43.

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*District Engineers in Principal Cities*

**NIAGARA** INDUSTRIAL COOLING • HEATING • DRYING HUMIDIFYING • AIR ENGINEERING EQUIPMENT

# DE-STA-CO Blower Wheel Housings

*of Standard Dimensions*

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

**DETROIT STAMPING CO.**

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375 Midland Ave • Detroit, Mich.

This is no time to take chances! ...These famous stokers are available for wartime installations.

*Let us help you!*

# FIRE-GUARD

*Automatic Coal Stokers*

Sizes from 66 to 400 lbs. capacity

*Wire, Phone or Write NOW!*

**PEERLESS MFG. CORP.** Louisville, Ky.

Heating Equipment for 58 years

# NEWS OF THE MONTH

### Waste Oil Licks Shortage

BOSTON — A firm in Waltham, Mass., Pierce Brothers, florists, keeps its sixteen greenhouses at temperatures from 80 to 90F burning oil that nobody wants—crank case oil, drainings from filling station tanks, dregs from tankers, and oil sludge so dirty that some of it has to be ground up. The firm's greenhouses house some 80,000 of the finest rose plants.

These Waste Oil Kings service 3,000 filling stations, draining tanks and waste crankcase oil. They keep five big oil trucks going daily, and are paid to take away waste oil, which they utilize later as fuel. During the current oil shortage they have not used one ration coupon, yet they burn 2,000 gallons of the waste oil a day.

### Martin Schiff

ST. LOUIS—Martin Schiff, chief engineer of Century Electric Company, died suddenly February 15.

Mr. Schiff was born in New York October 7, 1890, and graduated from Cornell University in 1912. Before joining the Century organization in 1933 he had previously been employed as a test engineer at Diehl Manufacturing Co., Elizabeth, N. J., from 1912 to 1913; assistant engineer of the Ideal Electric & Mfg. Co., Mansfield, Ohio, from 1913 to 1916, was in charge of a. c. design at the Electro Dynamic Co., Bayonne, N. J., during 1920, chief engineer of Roth Bros. & Co., from 1920 to 1929, and as assistant chief engineer and assistant to the president of the Imperial Electric Co., Akron, from 1929 to 1933. He is survived by his wife and two children.

### Smith, Hinchman & Grylls Elect New Officers

DETROIT—Smith, Hinchman & Grylls, 60-year-old Detroit architectural and engineering firm, recently elected new officers as follows: H. L. Walton, president; Wallace S. MacKenzie, vice-president-treasurer and Amedeo Leone, secretary.

These men carry on the conservation tradition that began in 1883 with Mortimer L. Smith & Son, the architectural firm that merged with the engineering firm of Field and Hinchman, organized in 1894. The firms combined in 1903 as Field, Hinchman & Smith and have been known as Smith, Hinchman & Grylls since 1907. This firm has a staff of 1200 architects and engineers working in many new industrial fields including synthetic rubber. The firm has been heavily engaged in the design of ordnance plants.

*H. L. Walton*

*W. S. MacKenzie*

*A. Leone*

### Canada May Subsidize Peat

OTTAWA—The Canadian peat fuel committee, a private body which is seeking to have the Dominion Government subsidize the peat industry, states that it is submitting plans to the emergency coal production board for construction of a number of proposed peat processing plants in Ontario and Quebec. Several of the plants would be close to Toronto, with others in the vicinity of Montreal and Ottawa. Total cost of building the plants in the two provinces is estimated at $10,000,000.

The proposed plants would have an annual production capacity of over 500,000 tons of peat briquetted fuel. Based on comparative heating values with lump anthracite, the committee claims that cost of the fuel to farmers in rural areas within reasonable distance of the plants will show a saving of not less than $5 per ton.

### Hartford Steam Utility May Quit

HARTFORD—If the 200 customers of Connecticut's only steam heat utility are forced to look for other means of keeping their buildings warm, they would at least be assured that the transfer would take place some time in June after restrictions on the sale of heating equipment have been lifted, if a bill passed by the State Senate becomes law.

The measure establishes detailed procedure whereby the Bristol Steam Heat Company, a corporation established by the bill, could discontinue operations only in June of any year and after giving its customers six months' notice of its intention. Specific provision is made that such notice may not be given until the present restrictions on manufacture, sale and installation of heating equipment are removed. The bill, SB 184, would permit the Connecticut Light and Power Company to dispose of its Bristol steam plant.

### NDHA to Meet in Pittsburgh

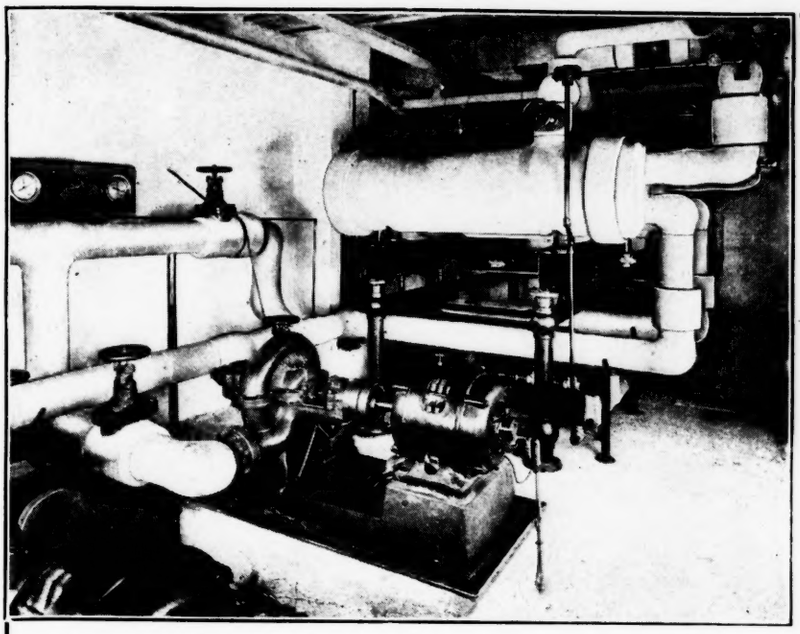
PITTSBURGH — The 34th annual meeting of the National District Heating Association will be held at Hotel Schenley here June 9-10. This will be strictly a technical meeting devoted to wartime problems of the steam utilities. Twelve technical committees will report and 28 papers will be presented on various phases of the industry.

For further information, address John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Avenue, Pittsburgh, Pennsylvania.

### Lab Seeks Technicians

PRIMOS, PA.—A call for assistant laboratory technicians to help with wartime research work and engage in development activity to improve anthracite home-heating after the war was issued here in mid-March. The technicians are needed in the laboratory of Anthracite Industries, Inc.

*(Continued on page 82)*



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## FOR HOT WATER HEATING SYSTEMS

- For gravity or forced circulation systems, in all sizes from 500 sq. ft. of radiation, up.
- Substantially constructed, with heating section of seamless copper U-bends — or straight tubes — economical and efficient.

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*For further information, see our catalog in Sweet's Catalog Files or write to our nearest office.*

Hot water heating systems—using Whitlock Convertors—prove more satisfactory and more economical than other heating methods . . . especially where steam is purchased from an outside source.

**THE WHITLOCK MANUFACTURING CO.**

40 South St., Elmwood, Hartford, Conn.

District offices in New York, Boston, Chicago, Philadelphia, Detroit

**Storage Heaters • Instantaneous Heaters • Convertors • Fuel Oil Preheaters • Chillers • Condensation Coolers**

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*Will it* **Help Win the War?**

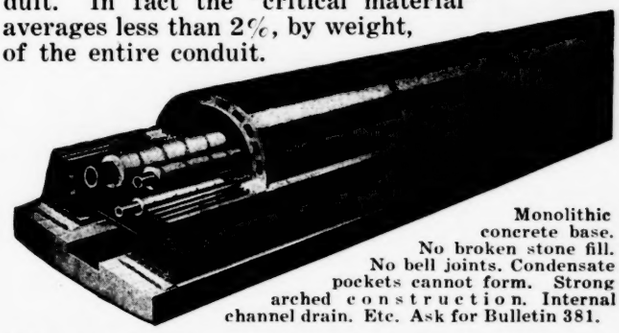
**That is the important test for every decision today. When applied to**

# THERM-O-TILE

*Reg. U. S. Pat. Off.*

## Underground Pipe Conduit

the answer is definitely "Yes" because you SAVE METAL when you use Therm-O-Tile. Pipe saddles and supports require the *only* metal in this conduit. In fact the "critical material" averages less than 2%, by weight, of the entire conduit.



Monolithic concrete base. No broken stone fill. No bell joints. Condensate pockets cannot form. Strong arched construction. Internal channel drain. Etc. Ask for Bulletin 381.

*Sold and installed by Johns-Manville Construction Units in all Principal Cities. See our page in Sweet's or The Heating Guide.*

## H. W. PORTER & CO., Inc.

**823-V Frelinghuysen Ave., Newark, New Jersey**

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

**Clip your name, firm, and address to this ad; tear out with the checked squares above, mail, and you will hear from us promptly.**

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INDICATING and RECORDING THERMOMETERS

**Some of the many different types of Dial Indicating and Recording Thermometers we make are shown here. We also make Recording Regulators and Regulators combined with easy to read Indicating Thermometers. Write for Bulletins.** Specify type of instrument in which you are interested.

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*Offices in 47 Cities—See your phone directory*

**50 Years** of Temperature and ★ Humidity Control ★

## 9000 Oil-to-Coal Conversions in Canada

OTTAWA — By the end of 1942, a total of 9,000 buildings in Canada were converted to coal with a resultant saving of more than 100,000,000 gallons of oil annually, according to the munitions department of the Canadian government.

## Down-Draft Burner for Coal Furnaces

URBANA, ILL.—Prof. Julian R. Fellows of the University of Illinois has developed a hand-fired fuel burning unit for house heating, which he terms a down-draft burner.

The burner idea is incorporated in two devices. One is a complete furnace, the other a conversion unit. Neither has any moving parts. Both will be available to the general public after the war. The conversion unit will retail at from $50 to $75, Professor Fellows reports.

Tests with and without the conversion burner in a conventional furnace show smoke reduction as great as 99%, it is claimed. Burning of the smoke and gas is accomplished by a hollow baffle wall which divides the firebox into two chambers joined by an opening in which the fire is located.

This baffle is built into the firebox of the furnace extending from its top down to the firebed. As heat drives smoke and gas from fresh fuel, these must pass under the wall and through the fire to escape. They are burned with auxiliary air coming through the hollow wall.

The adapter accomplishes this same purpose without any changes in present conventional furnaces. It is a boxlike affair which is pushed into the furnace door. The box has a door in front, hollow walls, and no bottom. Fresh coal is placed inside the box, which comes down to the fire in its usual place. Smoke and gas, escaping under the box sides, are burned with air coming through the hollow walls.

## Los Angeles to Revise Code

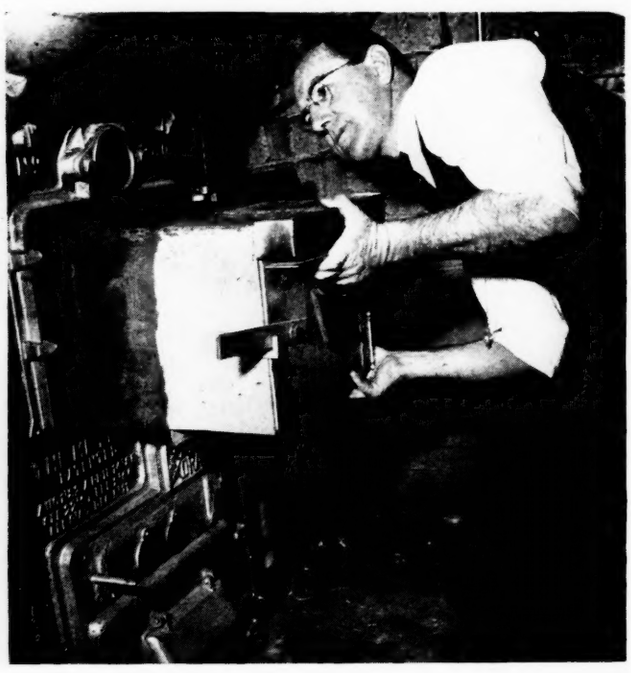
LOS ANGELES—Substantial revisions in the original draft of proposed municipal ordinance revisions regulating construction and installation of refrigerating plants in Los Angeles were submitted at a hearing on March 15 with the object of modifying restrictions applying to refrigeration men engaged in operations and repairs.

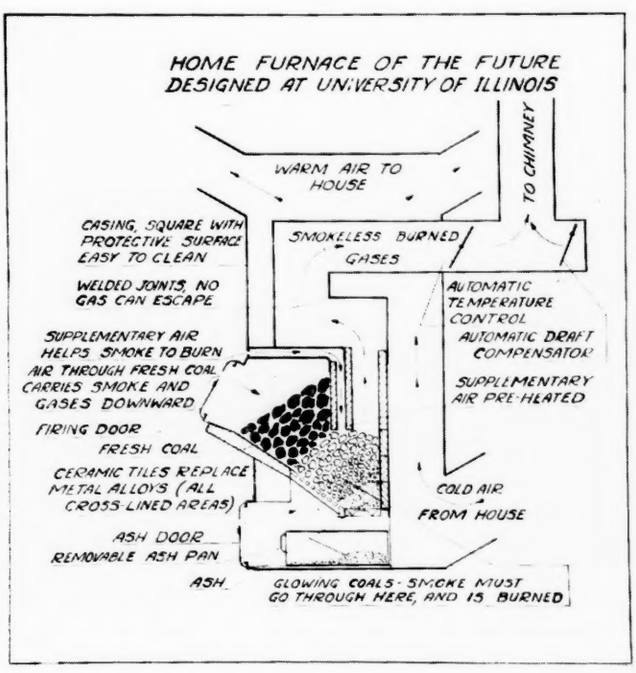
The original draft was designed largely to affect contractors and repair men of small refrigeration units. Modifications recommended to the City Department of Building & Safety by a special committee of Los Angeles Chapter, National Association of Practical Refrigeration Engineers, are intended to simplify and clarify the status of the heavy refrigeration industry, particularly refrigeration operating engineers.

The committee, headed by Ed L. Nelson, NAPRE secretary, also advised the board that operating engineers are opposed to a code proposal to create a classification of "refrigeration journeymen," who would be subject to qualification examinations before being permitted to work.

The proposed refrigeration code represents the first general revision since the city building code was adopted in 1932. Under the original draft, the refrigeration code would require registration with the city of all refrigeration contractors and journeymen plant installers and a qualifying examination to determine fitness. Applicants would also be required to pay an annual registration fee and refrigeration contractors would have to post a $1000 surety bond with the city.

The proposed code also sets forth requirements pertaining to the location of refrigerating equipment in public assembly and institutional buildings; construction and location of refrigerant valves and piping; and testing of refrigeration plants and allied subjects.




HOME FURNACE OF THE FUTURE
DESIGNED AT UNIVERSITY OF ILLINOIS
WARM AIR TO HOUSE
TO CHIMNEY
CASING, SQUARE WITH PROTECTIVE SURFACE EASY TO CLEAN
SMOKELESS BURNED GASES
WELDED JOINTS, NO GAS CAN ESCAPE
AUTOMATIC TEMPERATURE CONTROL
AUTOMATIC DRAFT COMPENSATOR
SUPPLEMENTARY AIR HELPS SMOKE TO BURN
AIR THROUGH FRESH COAL CARRIES SMOKE AND GASES DOWNWARD
SUPPLEMENTARY AIR PRE-HEATED
FIRING DOOR
FRESH COAL
CERAMIC TILES REPLACE METAL ALLOYS (ALL CROSS-LINED AREAS)
COLD AIR FROM HOUSE
ASH DOOR
REMOVABLE ASH PAN
ASH
GLOWING COALS - SMOKE MUST GO THROUGH HERE, AND IS BURNED

*Prof. Julian R. Fellows of the University of Illinois placing his down-draft conversion burner into the firing door of a furnace. With this device it is said that soft coal can be burned smokelessly in almost any furnace, at the same time saving fuel and producing more even heat. In designing the "Furnace of the Future," Professor Fellows worked with J. C. Miles, another University of Illinois engineer.*

### Smoke Pall Threatens Plane Plant Selection

BIRMINGHAM, ALA.—A new reason for enforcing Birmingham's smoke abatement ordinance has presented itself—that of clearing the skies for the landing of big bombers at the plane modification plant of Betchel-McCone-Parsons Company. The city is threatened with the loss of part of this plant, unless the pall of smoke about the city is lifted, and already federal officials have held up a large appropriation for additional runways at the municipal airport.

These developments have stirred civic pride and definite action is in the making leading to strict enforcement of the anti-smoke ordinance, which had been relaxed somewhat on account of the war and the attendant scarcities of improved firing equipment and smokeless fuels.

A recent survey showed that 60% of the city's smoke comes from private dwellings and apartment houses in which janitors and others tending the furnaces are not firing them properly. Flagrant violators of the law in this respect will be arrested.

### Blankin Speaks in Buffalo

BUFFALO—M. F. Blankin, president of the ASHVE, discussed The Society's Activities in Wartime before the Western New York chapter in the University Club here recently.

## PERSONALS AND PERSONNEL

### ALLEN J. JOHNSON

director of the Anthracite Industries Laboratory, Primos, Pa., is now located in the office of Anthracite Industries, Inc., at 2204 Walnut St., Philadelphia. Mr. Johnson continues in charge of the Laboratory but has changed his headquarters so as to make it more convenient for those wishing to see or reach him.

### JAMES A. STRACHAN

has been appointed sales manager of the refrigeration division of the Weatherhead Co., of Cleveland. Mr. Strachan was formerly sales manager of the Kerotest Manufacturing Co. of Pittsburgh, with which he was associated for 14 years. He is a director of the Refrigerator Equipment Manufacturers' Association.

### LEON E. JEANNERET

formerly assistant general sales manager of The Babcock & Wilcox Tube Company, Beaver Falls, Pa., has been appointed manager of sales of the welded tube division of The Babcock & Wilcox Co., with general offices and plant at Alliance, Ohio. Announcement is made also that Edward A. Livingstone, general sales manager of The Babcock & Wilcox Tube Company at Beaver Falls, Pa., has been appointed general sales manager of the company's welded tube division at Alliance, in addition to his present duties. William J. Thomas, manager of the company's mechanical tube sales at Beaver Falls, has been appointed assistant general sales manager, effective January 1, 1943.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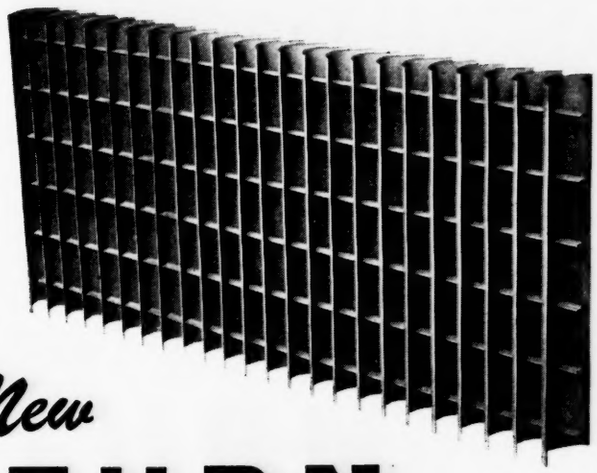
GRILLES & REGISTERS
AIR DIFFUSERS

ENGINEERED uni-flo GRILLES AND REGISTERS AIR DISTRIBUTION

AUTOMATIC CONTROLS

*First Again!...*

NEW TURNING VANE IS THE BEST NOW AVAILABLE COMMERCIALLY!



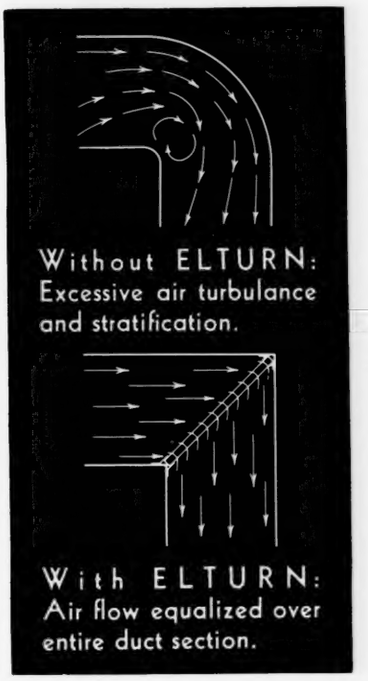
The *New*

ELTURN

*Aerodynamically Correct!*

85% REDUCTION OF LOSSES...

**The new ELTURN effects a substantial reduction in elbow pressure losses in any air distribution system that employs right angle turns, reducing by as much as 85% the losses caused by eddies, reverse air flow, and low pressure areas.**




CORRECT AERODYNAMIC DESIGN

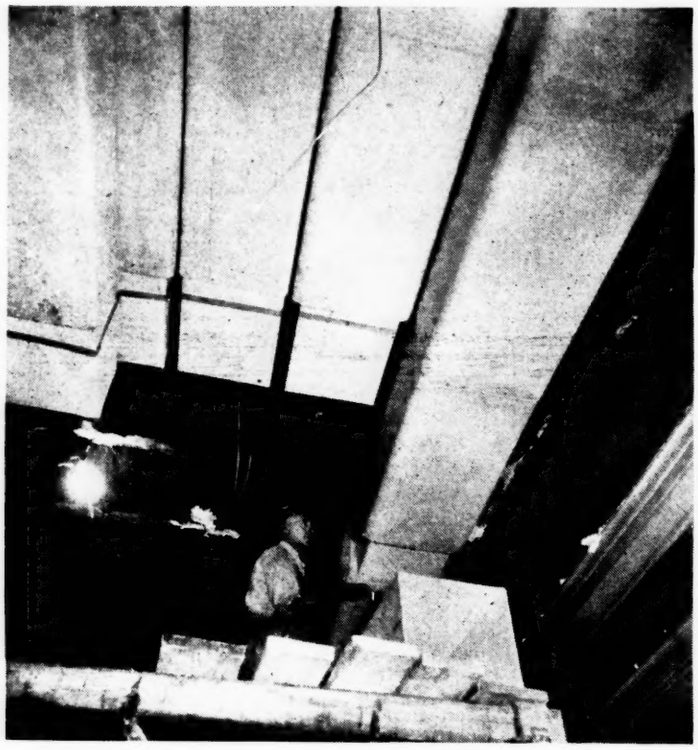
**The turning vanes were scientifically designed on the basis of best modern aerodynamic principles to obtain these outstanding improvements in performance. The New ELTURN has been thoroughly tested and proved, both in the laboratory and in actual service.**

WIDE SPACING POSITIVE INTERLOCKING

**The large free area of the New ELTURN precludes the possibility of clogging due to lint and dust. Distinctive construction make a strong and positively interlocked assembly. Write for sizes and other data.**

BARBER-COLMAN COMPANY 1224 ROCK STREET ROCKFORD, ILLINOIS

# Eliminate METAL DUCTS IN AIR CONDITIONING



Careyduct in new studios of radio stations WLW and WSAI

Specify Careyduct THE ALL-ASBESTOS INSULATED DUCT

Even before the war curtailed the use of metal, CAREYDUCT had won an enviable position in the air conditioning industry for its many outstanding advantages over insulated steel duct. Under present conditions, the fullest utilization of this all-asbestos duct is more essential than ever. In a recent job, over 65 car-loads of CAREYDUCT saved 1,500,000 lbs. of steel.

It has been demonstrated in hundreds of installations that the use of CAREYDUCT means greater efficiency . . . quieter operation . . . lower friction . . . lighter weight . . . easier installation . . . and actually lower cost than insulated metal.

CAREYDUCT is a natural sound absorber and non-conductor of sound. It hushes fan noises; reduces outside noise; eliminates metallic "cracking"; by effectively subduing noise, it allows use of smaller sizes with higher velocities; solves many difficult problems where space is limited. Steel will help win battles. By using CAREYDUCT you conserve steel and insure better air conditioning.

Write for full information. Address Dept. 49.

THE PHILIP CAREY MFG. COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY LTD., Office and Factory, LENNOXVILLE, P. Q.


### C. BARTON ALBRIGHT

consulting engineer, New York City, announces formation of a new consulting engineering firm to be known as Industrial Services Associates, 51 E. 42nd Street, New York. Associated with him in the new firm will be three engineers of wide experience in the industrial, mechanical and chemical fields.

### T. H. BANFIELD

president of the Iron Fireman Mfg. Co., Portland, Ore., was appointed a member of the Oregon State Highway Commission in March by Governor Earl Snell. Mr. Banfield is also president of the general contracting firm of Parker & Banfield, and director of the state of Oregon for the National Association of Manufacturers. He served as a member of the Capitol Reconstruction Commission which supervised the construction of Oregon's new capitol in 1936.

### JAMES R. McCALLUM

*J. R. McCallum*

has joined the engineering staff in charge of the laboratory of Airtemp Division, Chrysler Corporation. Mr. McCallum has been associated with the Chrysler laboratories in Detroit for a number of years, where he has specialized in the development of refrigeration and heat transfer equipment. He will work closely with Charles Neeson, Airtemp director of cooling research and designer of the Airtemp radial compressor, and will devote considerable time to the Airtemp post-war line of refrigeration machines.

### CARL H. FLINK

has been appointed technical secretary of the American Society of Heating and Ventilating Engineers, effective March 1. Mr. Flink will be responsible for the coordination of technical committee work and assist in the compilation of codes and standards and work closely with the *Guide* Publication Committee, and will be at the headquarters office of the Society, 51 Madison Avenue, New York.

*Carl H. Flink*

Mr. Flink, a graduate of the University of Michigan, has had 27 years of business and professional experience. He has been engaged in research and development work as chief engineer of the Institute of Thermal Research of the American Radiator Co., director of research for the American Gas Products Corp., and mechanical engineer in charge of product development laboratory of the American Radiator and Standard Sanitary Corp. His work included the development of equipment and tests of boilers, radiators, furnaces, air conditioners, oil and gas burners, hot water heating and control equipment. He is a licensed professional engineer.

### HERMAN ROHDE

has resigned as manager of the convector radiator enclosure department of Ferro-Co Corporation, Brooklyn, N. Y. Mr. Rohde has purchased a cold-storage business which he will operate.

### M. S. SMITH

has been elected vice-president and treasurer of Buensod-Stacey Air Conditioning, Inc., 60 East 42nd St., New York. Mr. Smith formerly was vice-president and general manager and W. J. McDonald, who was treasurer, has resigned to accept a Commission in the Navy. G. A. Dornheim, who has been in charge of process piping and the installation of boiler plants, has been elected as a vice-president and J. A. Lochran, the auditor of the company, has been elected as assistant secretary.

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## WITH THE MANUFACTURERS

### MODINE MANUFACTURING COMPANY

Heating and Air Conditioning Division, Racine, Wis., has appointed the following representatives: R. J. Shank, Des Moines, Iowa; E. W. Smith, Charleston, W. Va., and Joe P. Dillard, Dallas, Tex.

### MARSH TRITROL CO.

Chicago has appointed the Energy Control Co., Philadelphia and New York, as sales agents for Tri-trol regulator. The Philadelphia office of Energy Control Co., 3107 W. Broad St., will cover the Philadelphia area, including southeastern Pennsylvania, southern New Jersey and Maryland. The New York office, 205 East 42nd Street, will cover Connecticut and east central New York.

### THE PEERLESS ELECTRIC COMPANY

Warren, Ohio, is celebrating its 50th year in the electrical industry. The firm was founded in 1893 by Elmer W. Gillmer as The Warren Electric and Specialty Company. The first product was a carbon lamp, but transformers, electric fans, and direct current motors were added shortly afterwards. In addition to The Warren Electric and Specialty Company, Elmer Gillmer, who was an active pioneer in the electrical industry, founded The Economy Lamp Company, The Colonial Fan and Motor Company, Colonial Electric Company, and The Peerless Electric Company, under which name these various companies were all merged and incorporated in 1902.

Peerless sold the lamp and transformer business about 1907, and specialized in the manufacture of desk fans and electric motors. In 1932, the manufacture of desk fans was discontinued, and a line of exhaust fans and certain air conditioning equipment succeeded them.

The Golden Anniversary Banquet, held at Warren recently, celebrated 50 years of Peerless service both to the electrical industry and to users of fine electrical equipment. This affair was attended by employees, representatives from all over the United States, and distinguished citizens of Warren.

RUN YOUR UNDERGROUND STEAM AND HOT WATER LINES IN

BANNON
ADSCO TILE
CONDUIT

The metal that would be required if all underground steam and hot water lines installed this year were run in metal conduit, would build a surprising number of tanks and guns.

That is why ADSCO-Bannon Tile Conduit is America's No. 1 wartime conduit.

With the exception of a very small amount of metal used in pipe supports and rollers, ADSCO-Bannon Conduit is made of non-critical materials — Vitrified Clay Tile — fiberglas insulation.

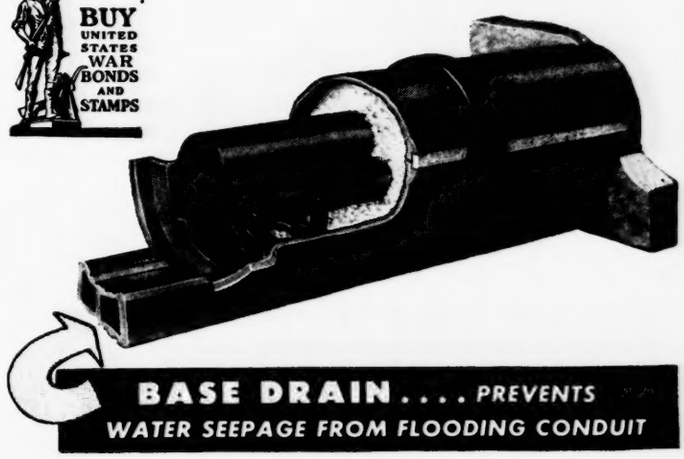
Also, in ADSCO-Bannon Tile Conduit, a specially designed tile base drain provides adequate drainage for the underground lines. This prevents flooding of the conduit, thereby maintaining its thermal efficiency. Easily installed with a minimum of labor —makes a permanent installation.

Submit details of proposed installation for prompt quotation or write for illustrated bulletin No. 35-67 V.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA N.Y.

MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS

FOR VICTORY
BUY UNITED STATES WAR BONDS AND STAMPS



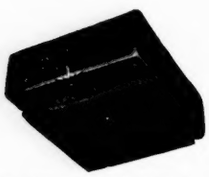
BASE DRAIN .... PREVENTS WATER SEEPAGE FROM FLOODING CONDUIT

# Young

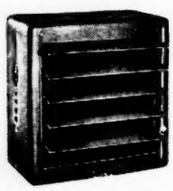
## HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

**for WARTIME NEEDS OF INDUSTRY**

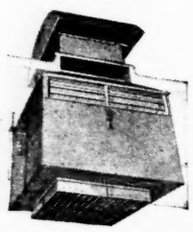
**No matter what your special needs may be, there is a YOUNG steel heating, ventilating or air conditioning unit designed and engineered for long life and maximum output. Your inquiry will bring complete information and specifications on this new type equipment.**



Vertiflow Unit Heaters for ceiling suspension. Propeller fan, vertical discharge. 10 models.



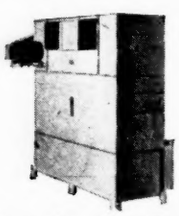
Horizontal Discharge Unit Heaters. 10 sizes of propeller fan type units.



New Vertivent Blackout heater and ventilator for roof installation in war plants.

Water Coils—Continuous tube type. Direct expansion evaporator coils on special order.

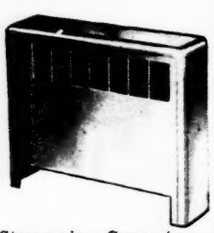
Heating Coils. Standard or steam distributing tube types.



Streamaire Air Conditioning Units. 16 Models, capacities from 400 to 16,600 CFM.

Ventilation Heaters designed with copper coils for marine heating and ventilating.

ALL of these units are available with copper coil construction for military contracts and essential industries where permitted.



Streamaire Convectors—Four cabinet types with copper cores for marine service.

**Buy Bonds—Produce More—Salvage Scrap—Win the War**

**YOUNG RADIATOR COMPANY**

DEPT 103D RACINE, WIS., U. S. A.

Young

HEATING, COOLING AND AIR CONDITIONING UNITS


### INDUSTRIAL UNIT HEATER ASSOCIATION

at its seventeenth annual meeting in Detroit, March 10, elected the following officers for the ensuing year: C. E. Scott, president; E. W. Petersen, vice-president, and L. O. Monroe, secretary-treasurer.

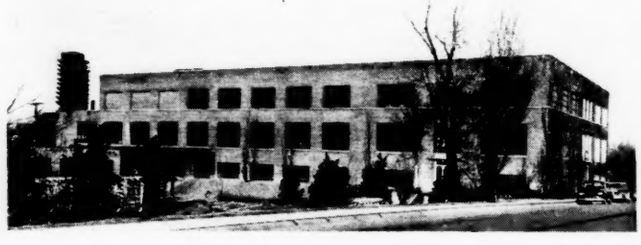
### DICKSON COAL CO., INC.

Rockefeller Center, New York, under the recent WPB ruling permitting the manufacture of a limited number of automatic stokers for civilian use, will distribute standard D &E automatic anthracite burners Model C, 21 in. open-hopper, spill-over type. This model has an annual capacity of from 25 to 60 tons of anthracite No. 1 buckwheat, equivalent to 5,000 to 10,000 gallons of oil. Ash-removal and bin-feed equipment and ash rings are not permitted, although these features may be added when the war emergency is over. Before an order for a stoker can be filled, the customer's application, on WPB Form PD-668, must be approved by the WPB field office.

### ALCO VALVE CO.

St. Louis, moved in March into a modern, three-story factory property at 865 Kingsland Avenue. The new plant doubles the floor space of the company's three vacated plants. Two diesel-driven generators, supplying light, heat and power and a refrigerating system and large storage tanks make the plant virtually independent of public utility service in an emergency. The company, leaning heavily on engineering research since its inception, has installed a series of laboratories which will afford the most exhaustive study in the fields of refrigeration, air conditioning, hydraulics, and related electrical influence. The refrigeration laboratory includes an insulated "hot" room equipped with electric heaters for maintaining temperatures up to 120F; an insulated controlled-atmosphere chamber equipped with blower, steam heating coils, refrigerated cooling coils, and water atomizer for maintaining any desired combination of temperature and humidity in testing air conditioning equipment; and an insulated room for temperatures as low as —120F, for testing low temperature equipment.

The fully equipped hydraulic laboratory has a large altitude chamber to test aircraft accessories under conditions simulating flight at high altitudes. An unusual feature, highlighting employee working conditions and recreation, is the landscaping of a one-acre sunken garden or park adjoining the building. Created some years ago, this attractive area is adorned with shade trees, arbors, pathways, benches, and a fountain.



*New Alco Valve plant.*

## TUBE TURNS

of Louisville, Kentucky, announces the appointment of Fred C. Smith as chief metallurgist, effective January 18. Since 1936 Mr. Smith has been chief metallurgist for the Carnegie-Illinois Steel Company at Chicago, and prior to that was plant metallurgist for the International Harvester Company at Fort Wayne and Chicago. He is well known in metallurgical circles, having been elected vice-president of the American Society for Metals in May, 1942, resigning this office when he came to Tube Turns.

His responsibilities at Tube Turns include supervision of all raw and finished materials inspection, forging operations, heat treating, and metallurgical research and service. Tube Turns manufactures a complete line of all sizes and types of welding fittings, and special forgings for the aviation industries and U. S. Ordnance.

ARMY – NAVY

E

AWARDS

DeLaval Steam Turbine Company, Trenton, N. J.

Gilbert & Barker Manufacturing Company, West Springfield, Mass.

## INDUSTRIAL DEGREE DAYS FEBRUARY, 1943

| City | Number of Industrial Degree Days | |
|---|---|---|
| | 55F Base | 45F Base |
| Baltimore | 458 | 232 |
| Buffalo | 816 | 541 |
| Chicago | 762 | 484 |
| Cleveland | 684 | 416 |
| Detroit | 734 | 480 |
| Indianapolis | 652 | 385 |
| New York | 584 | 332 |
| Philadelphia | 537 | 292 |
| Pittsburgh | 591 | 347 |
| St. Louis | 431 | 226 |

## COMING EVENTS

APRIL 9-10—Midwest Power Conference. To be held at the Palmer House, Chicago, Ill. For further information write Illinois Institute of Technology, Chicago.

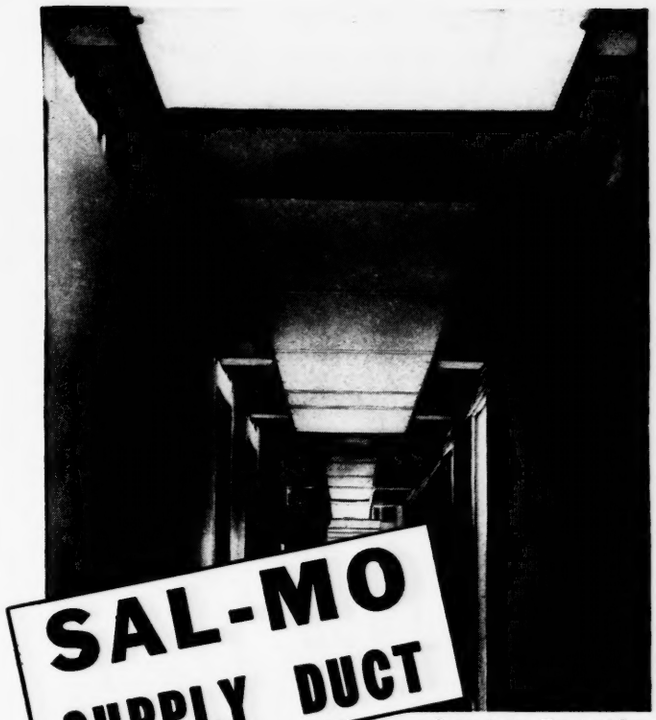
JUNE 9-10.—34th Annual meeting of the National District Heating Association, to be held at Hotel Schenley, Pittsburgh. For further information, write John F. Collins, Jr., Sec'y-Treas., 827 N. Euclid Ave., Pittsburgh, Pa.

## H&V's PHOTOS

Pages 33-36—Carbide & Carbon Chemicals Corporation, New York.

Page 54—The Austin Company, Cleveland, O.

Pages 64-67—Carrier Corporation, Syracuse, N. Y.


*Showing a Typical Installation of Sal-Mo Supply Duct in a Defense Housing Project. Metal Was Used Only For Fittings, and Hangers*

NON-METALLIC MATERIAL for constructing ducts for Warm Air Heating, Ventilating and Air Conditioning systems. Sal-Mo Supply Duct permits many installations that would otherwise be impossible because of the shortage in metals.

Sal-Mo Supply Duct, because of its low conductivity rate, assures efficient operation in both heating and cooling systems. Friction loss is low because of smooth interior surfaces. Air tight construction prevents heat loss.

Fabrication and packaging at the factory brings labor costs, shipping, trucking and storage expense to a minimum.

**PROMPT DELIVERY**—Sal-Mo Supply Duct is available in any quantity, in a complete range of sizes for domestic or industrial requirements. Furnished also in flat sheets for fabrication of ducts or for insulation.

**APPROVED and LISTED BY UNDERWRITERS' LABORATORIES, INC.**

*Sal-Mo Supply Duct is Tested For:*

Fire Hazard Classification; Inflammability; Fire Retardant Classification; Fire Spread; Moisture Absorption.

**Write For Information Regarding These Tests**

**SALL MOUNTAIN COMPANY**

176 W. Adams St. Dept. B Chicago